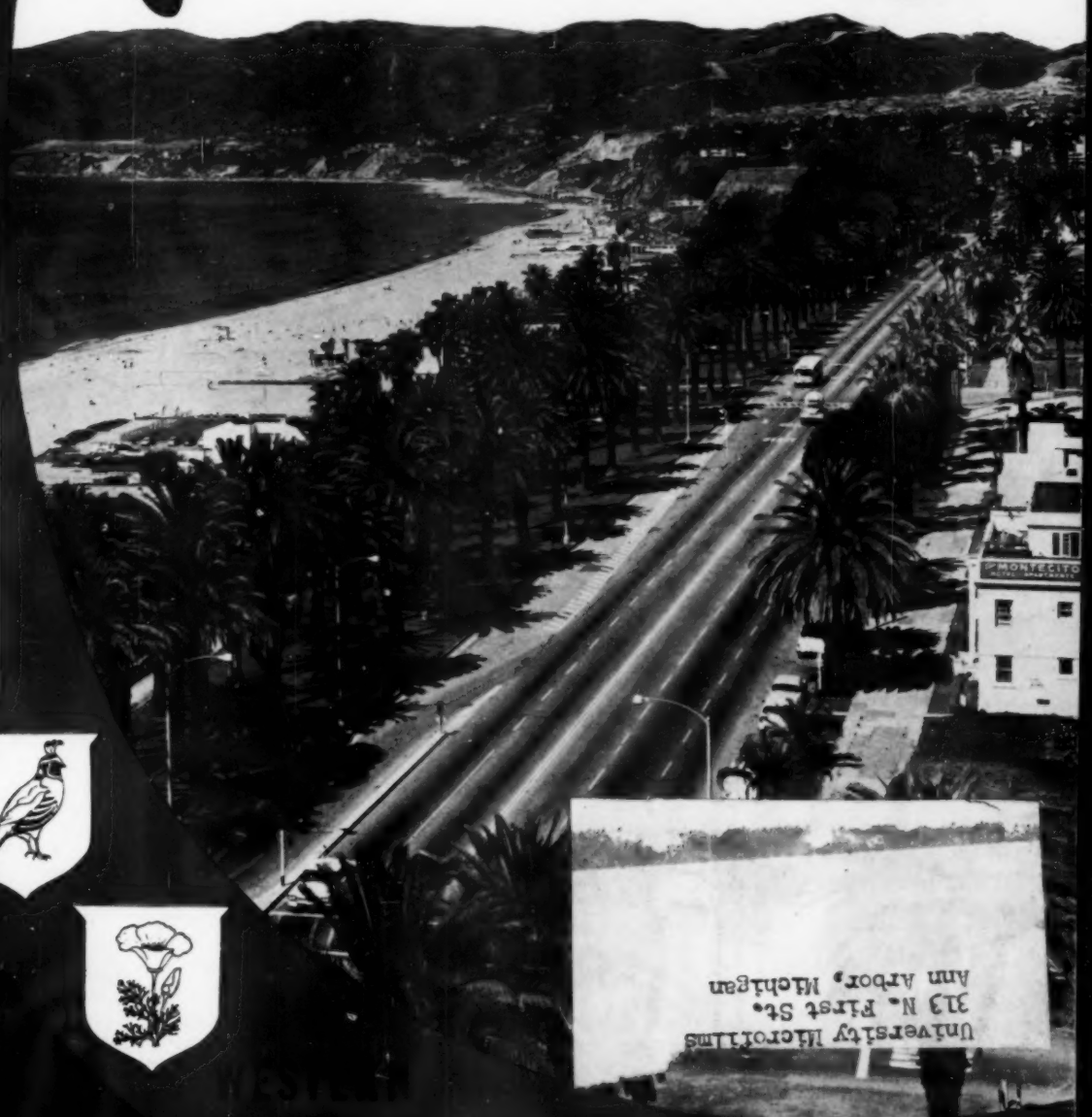
plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY



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PLATING MAGAZINE

AMERICAN ELECTROPLATERS' SOCIETY

FROM MISSILES AND ROCKETS

Precious Metals Plating Processes to meet your every requirement

The newest rockets, guided missiles, earth and sun satellites have a SEL-REX PRECIOUS METAL ELECTROPLATE on their electronic equipment and circuitry. The same quality and precision demanded by such applications is also being provided to leading jewelry manufacturers to help them make better, more salable products—at lower cost.

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* **DOPED GOLD PROCESSES** — doped with antimony or indium, depending on desired characteristics — best for Silicon and Germanium semiconductor applications.

* **TEMPEREX®** — Produces pure 24K Gold electroplate which will withstand higher temperatures than any pure Gold plate known.

* **THERMOKARAT®** — Produces exceedingly hard (470 Vickers) 18K Gold electroplate for decorative or industrial applications.

* **RHODEX®** — a patented Rhodium plating process which yields compressively stressed, crack-free deposits, permitting thicker Rhodium electroplate than ever before possible.

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* **KARATCLAD® GOLD PROCESSES** — acid Gold processes for decorative applications — Jeweler's Finish in any thickness, in a wide range of non-varying colors.

BRIGHT RHODIUM PROCESS — yields brilliant, fine grained, non-tarnishing deposits. Manufactured in our own air conditioned laboratories, its purity assures consistent quality results for all decorative applications.

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SILVER SOL-U-SALT® — a water soluble double cyanide salt — permits new ease and facility in the preparation of Potassium Silver Cyanide plating solutions.

POTASSIUM GOLD CYANIDE — the purest available — used in the preparation of our own exclusive Gold Plating Processes — manufactured in moisture controlled facilities.

INDUSTRIAL SILVER PLATING PROCESSES — a complete line of silver plating formulations for high speed industrial applications.

*Patented and patents pending.

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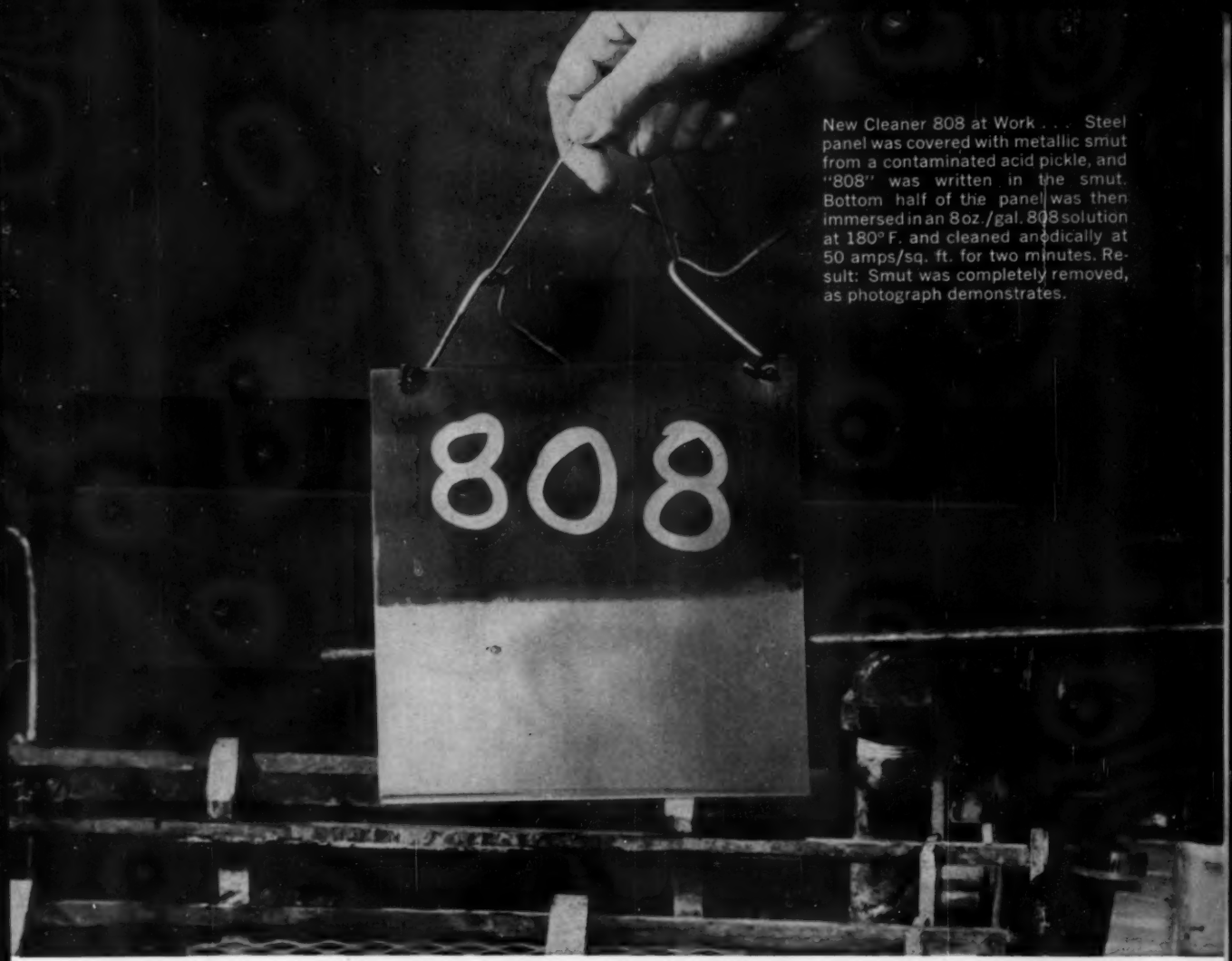

New Cleaner 808 at Work . . . Steel panel was covered with metallic smut from a contaminated acid pickle, and "808" was written in the smut. Bottom half of the panel was then immersed in an 8 oz./gal. 808 solution at 180° F. and cleaned anodically at 50 amps/sq. ft. for two minutes. Result: Smut was completely removed, as photograph demonstrates.

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Cleaner 808, a new development of Enthonics research, is an alkaline electro-cleaner with chelating action. Its selective chelating agents chemically encircle and remove smut, oxides, light scale and rust. Its high-detergency, high-conductivity ingredients complete the cleaning job. Result: Bright surfaces completely free of contamination.

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Cleaner 808 is a dustless, free-flowing alkaline powder with superior wetting, penetrating and dispersing characteristics, and water softening action. A low foam blanket minimizes spray and hydrogen gas explosion. Because oils are displaced and float to the surface, the cleaning solution is free of contamination, has long life.

For complete information about Cleaner 808 with chelating action, write to Enthone, Inc., 442 Elm Street, New Haven 8, Conn.

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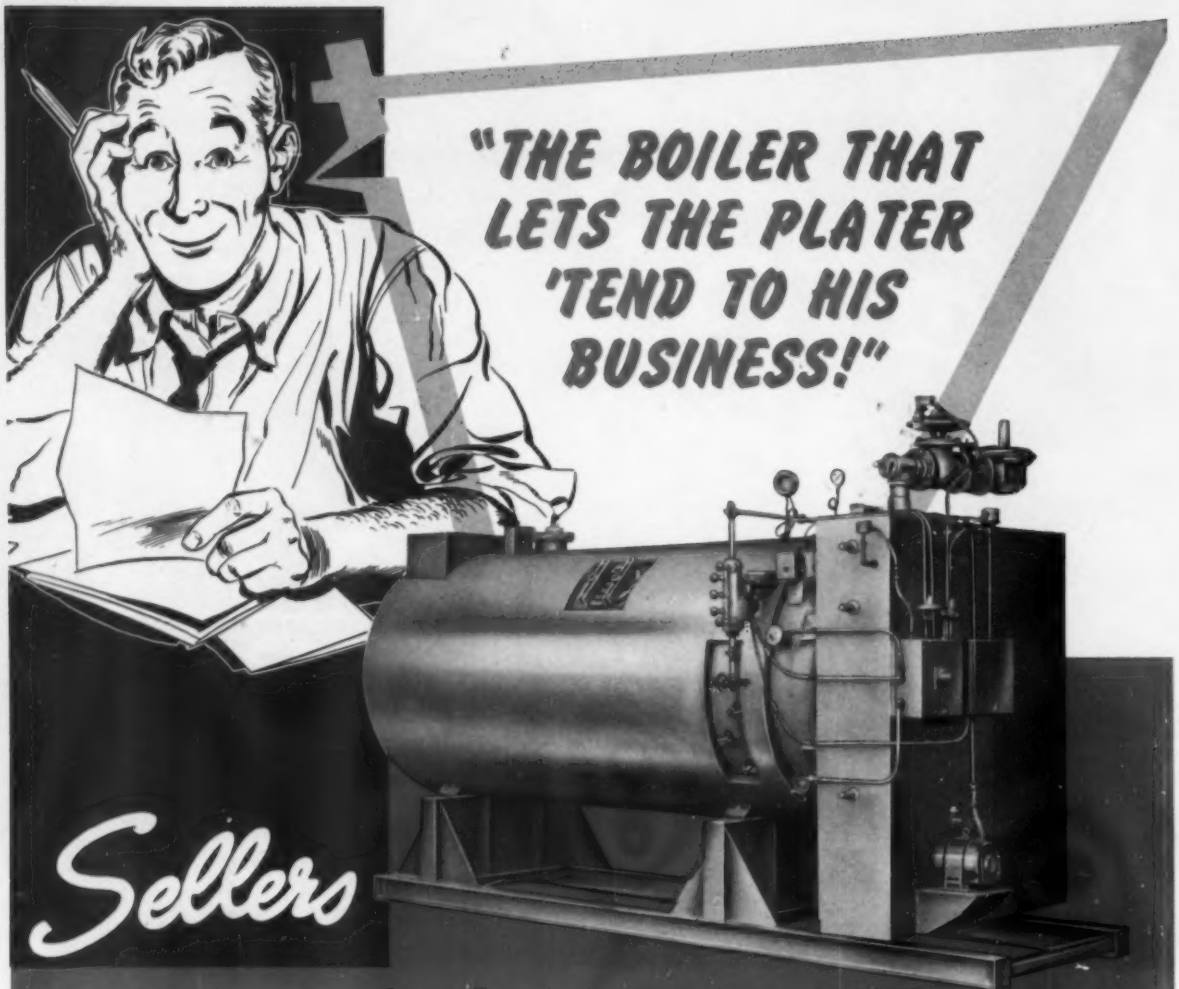

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JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

WESTERN ISSUE

JULY 1960 — **Vol. 47, No. 7**

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Published by the American Electroplaters' Society, Incorporated, 445 Broad Street, Newark 2, N. J. Phone: HUmboldt 2-3400. Yearly subscription for Members $2.00. Nonmembers U.S. and Canada $5.00. 65c a copy. Foreign, $8.00 a year, $1.00 a copy. Non-member back issues, Six months or older $1.00 a copy (Golden Jubilee Issue and Fiftieth Anniversary Issue each $2.00 a copy).

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PLATING is indexed in Applied Science and Technology Index and abstracted regularly in Chemical Abstracts, Metals Review, Metalworking Review, Metallurgical Abstracts, Engineering Index, Technical Data Digest, and Bulletin Analytique.

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Second class postage paid at Philadelphia, Pennsylvania.

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EDITORIAL

EVOLUTION

LAST YEAR WHILE WE WERE celebrating our Fiftieth Anniversary, a group of educators and newspaper men were making much ado about the Hundredth Anniversary of the publishing of Charles Darwin's "Origin of Species". We do not wish to get into any controversy about this subject such as was engaged in by William Jennings Bryan and Clarence Darrow at the famous trial of some years back. This does not, however, prevent us from having an opinion on Evolution of another sort, one not quite so controversial. Our theory is that Evolution is simply a way of life for man, for industry and for science.

We can readily discern Evolution in nearly everything in which man has had a hand. All theory evolves from what has gone before, constantly new yet constantly grounded in the past. New developments are a continuing evolutionary process, aided at times by some significant invention but more often simply following the patterns of the past into modifications that are better. Drive your 1960 model car out to a Vintage Car Club Meeting and look around. Compare the modern cross country trucks with the old Conestoga Wagons still used in the TV program "Covered Wagon". Most cars and trucks still have the engine in the front, even as the horse was in front of the wagon. Most of the changes we see today are the result of re-arrangement of basic principles that were old when we were young, the result of trial and error, the result of many people thinking about better ways to do things.

Our American Electroplaters' Society is proud of its past fifty-one years, and the evolution that has taken place, not only in our Society, but in the science and industry it represents. Through the work of our Research Committee and the many projects it fosters, and the thousands of people in our industry who are continually looking for something new or a better way to do something, we have advanced a long way. Our plating and finishing is much better today than it was five or ten years ago and because everyone is trying to find something better, it will continue to improve in the coming years. In the Organic Field, new materials for coatings are being announced almost every day, and through evolution in the synthesis of our present organic compounds, many new ones will be developed in the future.

There is, seemingly, no limit to the extent to which our Science and Industry will be advancing, so we, the present membership of the American Electroplaters' Society, must do our best today and insure its constant growth in the future. As the strength of our Society is the strength of our Branches, so the future of our Society is the future of our Branches.

Ralph D. Wysong

President
American Electroplaters' Society, Inc.

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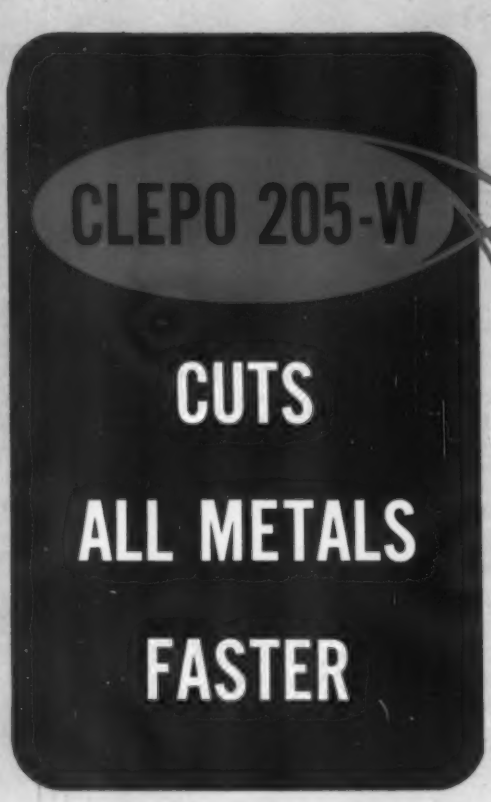

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PROTECTION AGAINST CHEMICAL ATTACK

CLEPO 205-W contains compounds which protect the base metal against chemical attack and maintain a clean surface color.

CONTINUOUS CUTTING EFFECTIVENESS

CLEPO 205-W prevents the tumbling medium from being impregnated with metallic grindings. There is no coating build-up to slow the cutting action. The medium continues to cut with maximum effectiveness throughout the tumbling cycle.

Send for
Technical Bulletin 660

FG2-7

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YOU the advertiser, as a merchandiser channeling products to market for popularization and sale, are interested in any monthly magazine serving the electroplating, metal finishing and allied arts field for ONE reason and one reason ONLY, namely its demonstrable qualifications to bring the sales promotion story of YOUR products effectively to market. As an advertiser, YOU are interested in PLATING MAGAZINE, for instance, wholly for this purpose—and that's the basis upon which PLATING MAGAZINE is, in turn, interested in YOU the advertiser.[1]

That's why PLATING MAGAZINE has published the little booklet whose cover is pictured above—so that, from its illustrated, simply written pages, YOU the advertiser can glean all the information that you need to determine for yourself as to whether or not it is of DOLLARS and CENTS importance to YOUR company to employ PLATING's advertising columns, regularly and to maximum extent.

Copies of the booklet have issued, or will soon issue, to a large number of representative companies and their advertising agents, with whom PLATING MAGAZINE already enjoys a mutually esteemed relationship, or with whom PLATING desires to create such a relationship. If through some mischance, YOUR copy has not yet reached you, do please write us. (PLATING MAGAZINE, American Building, 443-445 Broad Street, Newark 2, N. J.)

Without obligation or cost to you of any sort, a copy will promptly be sent because, as said, the friendly primer was conceived, written and published by PLATING MAGAZINE exclusively to serve YOU the advertiser.

(1) PLATING MAGAZINE is happy indeed that the following have returned to its advertising columns after an absence: Agate Lacquer & Manufacturing Co., Inc. • Ardco, Inc. • Crown Chemical & Engineering Co. • Hoffman Control Co. • Industrial Filter & Pump Manufacturing Co. • Mass & Waldstein Co. • Magnus Chemical Co. • The Matchless Metal Polish Co. • Michigan Chrome & Chemical Co. • Munning & Munning, Inc. • Murray Products • George L. Nankervis Co. • Packer Machine Co. • Pennsalt Chemicals Corp. PLATING is also happy to welcome these new 1960 advertisers: American Titanium Corporation • Barrett Chemical Products Co. • E. S. Browning Co. • Chrome Engineering, Inc. • Culligan Special Dealers Group • Robert Draper Ltd. • Dyna-Empire, Inc. • Electrofilm, Inc. • Indust Corporation • The MacMillan Co. • Pfaudler Co. • Rome Cable Corp. • St. Martin's Press • U. S. Paint Lacquer & Chemical Corp. •

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DUROBRITE®

ADDITION AGENT 26

Flexible polyethylene spout permits easy pouring and measuring . . . pops back into metal drum when not in use.

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EXCELLENT STABILITY. "Durobrite" Addition Agent 26 stays effective longer. It produces bright plates even at bath temperatures as high as 110°F. Brightening effectiveness continues during idle periods so there's no need to add large amounts of brightener after weekend shutdowns. Decrease in brightening activity in the bath is gradual . . . minimizing rejects and the necessity of reprocessing parts.

NO BRIGHT DIPPING. You can obtain any predetermined degree of brightness—up to full liquid brightness—without bright dipping.

LOW USE COST. Extensive field tests indicate that the high stability of "Durobrite" Addition Agent 26 makes it economical to use . . . you use less brightener and plate more parts.

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CONVENIENT LIQUID FORM. An easy-to-use liquid, "Durobrite" Addition Agent 26 may be added to the bath "as is" or as a diluted stock solution.

HANDY CONTAINER. Convenient polyethylene-lined metal container (40 lb. net) has handy utility spout which allows easy pouring and measuring (see above). Spout pops back into container for easy storage.

High-quality brightness and excellent coverage are obtained with new liquid "Durobrite" Addition Agent 26.

...for barrel zinc plating

Other Brighteners in Du Pont's Plating Chemical Line. "Durobrite" Addition Agent 26 rounds out Du Pont's complete line of high-quality zinc brighteners:

"DUROBRITE" ADDITION AGENT 309—An extremely economical brightener (liquid form) for cyanide zinc solutions. Small amounts give a bright, uniform, lustrous plate.

"ZIN-O-LYTE" BRIGHTENER—Widely used powder form ... gives brilliant blue-white zinc plating without bright dipping.

"ZIN-O-LYTE" SPECIAL—An economical brightener (powder form) for barrel plating that gives bright deposits without bright dipping.

Whatever your requirement may be, Du Pont zinc-plating brighteners will give you bright, uniform deposits of the finest quality. For more information on new "Durobrite" Addition Agent 26 or other Du Pont brighteners, call your nearest Du Pont distributor or district office, or write: Du Pont, Electrochemicals Department, Sodium Products Division, Wilmington 98, Delaware.

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CYCLEFLEX Full Automatic Plating & Anodizing Machine.
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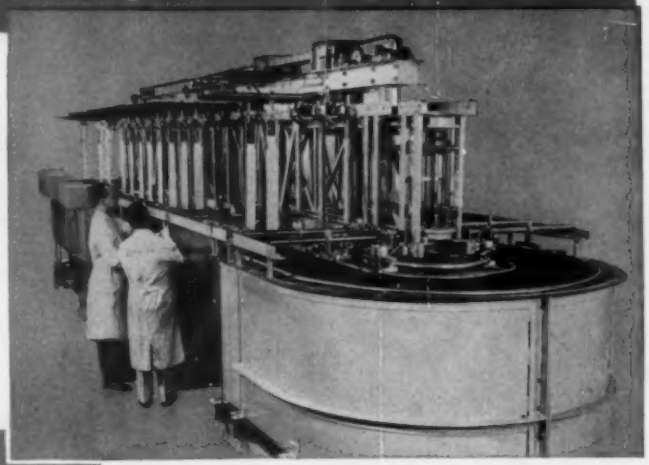
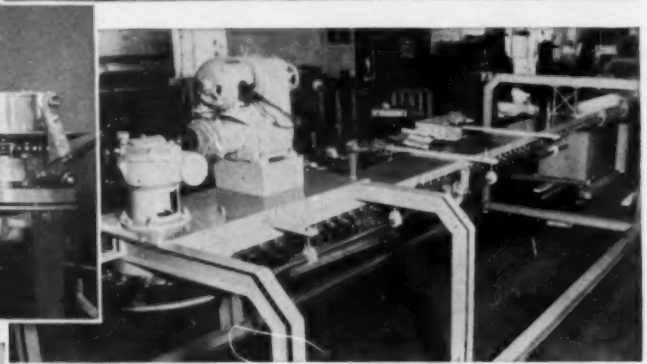
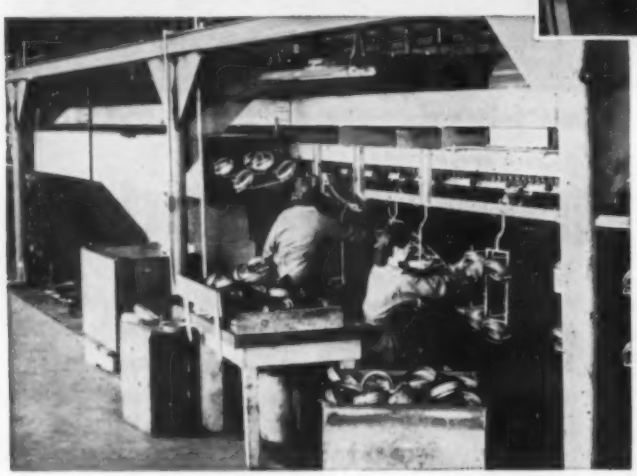


SELECT-O-MATIC Multiple Process Plater.
Handles 2, 3 or more process cycles at one time! While loading, operator merely turns dial to select desired cycle for individual racks and the rest is fully automatic! One operator can handle several different processes simultaneously. Saves investment in a variety of machines—reduces floor space requirements—cuts maintenance to a minimum.





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Fully automatic handling of individual parts. Tailor-made for any production output and any cycle. Tank to tank work transfers raise carriers to above horizontal to prevent solution carry-over, and eliminate air or gas pockets in work. Automatic unloading if work permits.

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A synthetic air-dry rack coating for all plating cycles and phosphate coatings—highly resistant to all plating solutions.

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For masking of machined parts for all plating cycles. Hairline demarcation . . . extreme accuracy.

MICCROMASK . . .
For masking of machined parts for hard chromium plating. Provides complete protection—assures extreme accuracy.

MICCROPEEL . . .
Specially designed to supply the need for a stop-off lacquer that can be peeled easily from the part after plating, and will hold a hairline demarcation through all plating cycles.

MICCROWAX . . .
Two widely used waxes for selective stop-off, especially suited for masking on complicated parts and sharp edges. C-562 for hard chromium; C-600 or high-temperature cycles.

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Industrial corrosive-resistant coating for use on all plating equipment, rinse tanks, structural steel, walls, floors, pipe lines, air ducts, etc.

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AND CHEMICAL COMPANY

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DRAMATIC ELECTROCLEANING METHOD cuts costs, increases production

...and Sharply Reduces Rejects!

Combine the speedy action of Diversey No. 15 Soak Cleaner and Diversey No. 35 Electrocleaner and watch production rates rise and cleanliness climb to an all time high. This double-treatment results in more adherent plate. Rejects reduce to a minimum. Per unit costs go down.

Here's the application that could well create a new peak along your high speed production lines:

DIVERSEY NO. 15 HEAVY DUTY SOAK CLEANER

High speed removal of oily contamination • thorough emulsification • exceptional wetting action.

DIVERSEY NO. 35 HIGH CONDUCTIVITY ELECTROCLEANER

Maximum conductivity . . . permits full loading of racks • produces water break-free, smut-free surfaces, even in low current density areas.

Maintenance savings, too. Both cleaners deliver a new high in contamination tolerance for long solution life. And their advanced type water softening properties prevent hard precipitates from forming on tanks, reducing maintenance and down-time.

Get the facts now on the new cleaning combination that can give you better plating at less cost. See your Diversey D-Man or write Metal Industries Department, The Diversey Corporation, 1820 Roscoe Street, Chicago 13, Illinois.

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Be Our Guest

Cocktails, music and entertainment
5 to 7 p.m.
East Garden Room
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the Statler Hilton Hotel
10 p.m. to 2 a.m.—Thursday, July 28
Marshall McGraw and his Music

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Detroit, Michigan

THE L. H. BUTCHER COMPANY
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Kanigen®

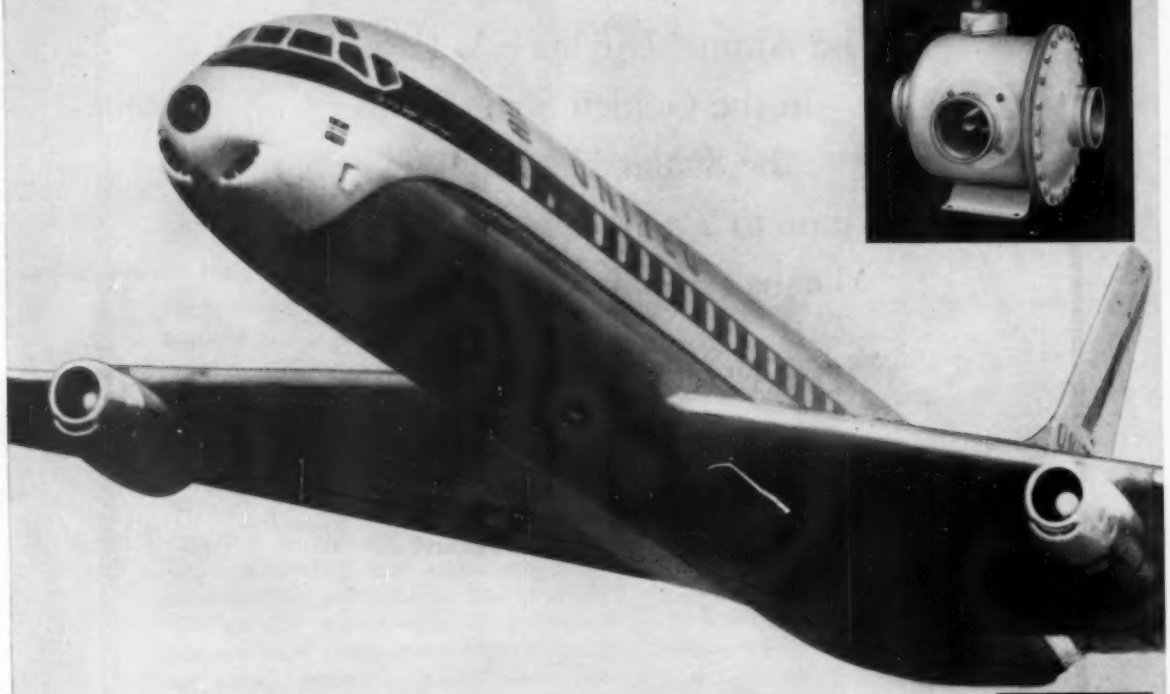
helps keep jet aircraft where the money is ...in the air

Big jet aircraft make money only when they are in the air. Every minute they are earthbound is costly. You just can't take chances on failure of aircraft engines from fuel contamination, or on failure of refueling equipment. That's why those parts of Brodie BiRotor refueling meters and control valves that come in contact with the fuel are chemically plated with KANIGEN nickel alloy.

Brodie BiRotor meters have been used for controlling aircraft refueling for many years, and their internal parts have been KANIGEN-coated ever since this highly accurate method of plating difficult or complicated surfaces was perfected.

Do you have a corrosion or contamination problem? Is it a small part like the Brodie meter housing? Or is it a surface as large as the inside of a 20,000 gallon tank car? Whatever it is, there's a way to solve your problems with KANIGEN chemical nickel plating. Write or phone the nearest General American office.

It pays to plan with General American.



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CORPORATION
135 South LaSalle Street
Chicago 3, Illinois
Offices in principal cities

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Wyandotte's amazing new development for steel electrocleaning!

Never before an electrocleaner like this! New MAXAMP delivers a new high in performance; brings you outstanding efficiencies never before possible.

MAXAMP's new and greater conductivity and maximum detergency handle those really tough jobs: stubborn smut, buffing and polishing compounds; phosphate coatings from drawing operations. Cleaning results are remarkable — your plating is mirror bright and stain free!

MAXAMP gives unequaled performance in handlines and automatics. Also important: MAXAMP is anhydrous, which means you buy *all cleaner*, no built-in water. Gives maximum results with minimum concentrations. And there's ideal foam control—no explosions, yet keeps fumes from escaping.

So, if you're interested in more efficient electrocleaning operations—and who isn't?—it'll pay you to investigate MAXAMP. It's the "new king of steel electrocleaners!" Call your Wyandotte representative for a demonstration, today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

NOW

Alcoa aluminum patented integral web channel bus available in 8 sizes

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This patented* design, introduced by Alcoa in 1956, has been expanded to eight sizes, providing capacities from 2,800 to 12,000 amperes.

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Moreover, you can make joints, taps, and splices by clamping, bolting, or welding. The table shows the sizes, capacities and weights from which you can choose to meet your exact needs.

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Size	Nominal Current† (amperes)	Wt./ft. (lbs.)
4 x 4	2,800	5.4
4 x 6	3,500	7.1
5 x 6	4,050	8.9
5 x 8	5,000	11.7
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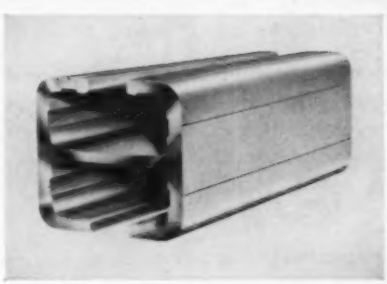
11 x 11	10,000	31.0
12 x 12	12,000	38.0



†Based on 30°C rise above 40°C ambient still air

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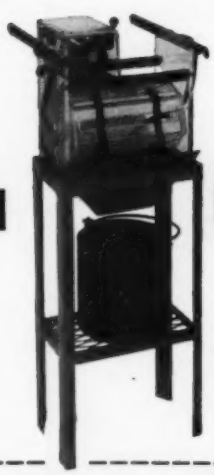

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DRAMATIC and fitting climax of its year-long FIFTIETH ANNIVERSARY observance, American Electroplaters' Society, Inc. (AES) conducted its unique Golden Jubilee Convention and Industrial Finishing Exposition, including the concurrent Fifth International Conference on Electrodeposition and Metal Finishing, in Detroit, Michigan, June 15-19, 1959.

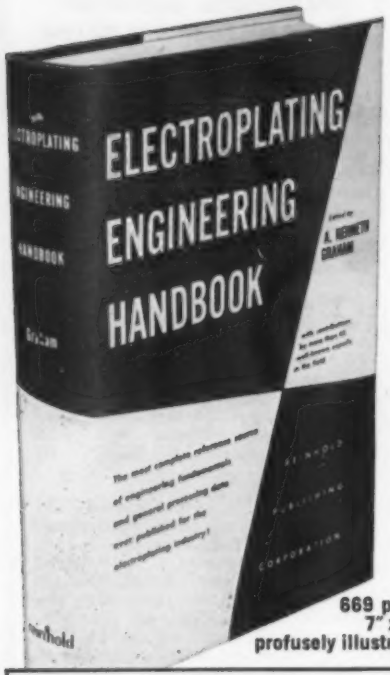
GREETED by the President of the United States, the AES was welcomed to Michigan and Detroit by Governor G. Mennen Williams. The entire week of the AES's Convention, Exposition and International Conference was proclaimed by Detroit's Mayor as "AES GOLDEN JUBILEE WEEK IN DETROIT."

AS the Fifth International Conference on Electrodeposition and Metal Finishing, the Golden Jubilee Convention's educational sessions numbered eleven. Experts from nine countries, including the United States, England, Canada, Australia, France, Germany, Holland, India and Italy, presented 43 technical and scientific papers enriching knowledge in electroplating, metal finishing and allied arts. High spot of the sessions was the first "William Blum Lecture" that was delivered by the eminent Dr. William Blum, first winner of the AES Scientific Achievement Award, the Society's highest honor.

UNDER the supervision of the AES's Editorial Board, in collaboration with the International Council on Electrodeposition and Metal Finishing, the International Conference was planned for the AES by AES Past President Walter L. Pinner, Chairman of the International Council. His Committee included Dr. T. P. Hoar, Dr. Simon Wernick, A. W. Wallbank, R. A. F. Hammond and George Gardam of England and Myron B. Diggin, Dr. Walter R. Meyer and Dr. Richard B. Saltonstall of the United States.

OPENING SESSION OF THE FIFTH INTERNATIONAL CONFERENCE ON ELECTRODEPOSITION AND METAL FINISHING

(1) Chairman Walter L. Pinner extending official welcome. Dr. William Blum, AES Scientific Award winner, seated. (2) Crowded auditorium at the first session. (3) Session Chairman T. P. Hoar introducing Dr. Blum, who delivered the first William Blum Lecture



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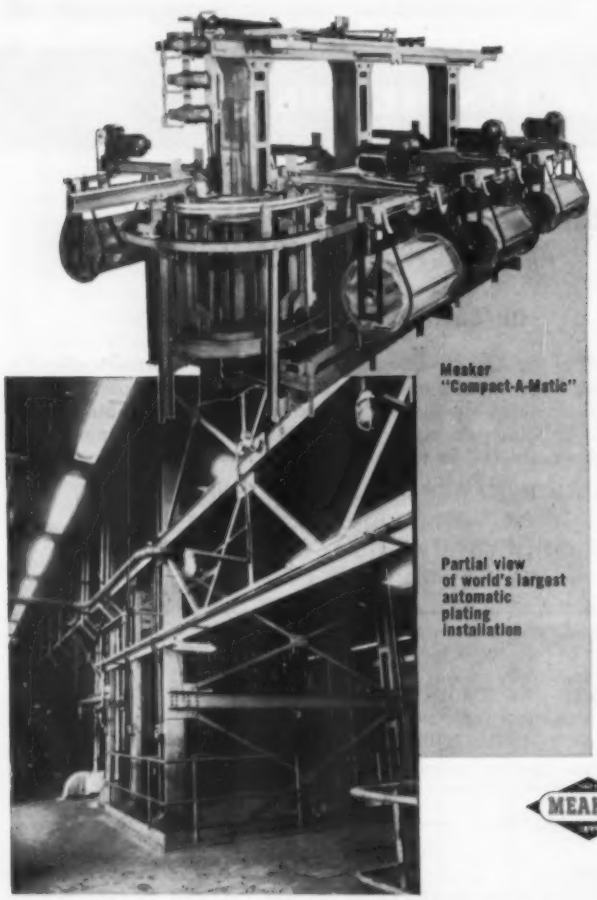

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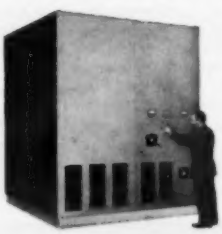

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Among the materials covered are zinc coated wire, strands, fencing, sheets, pipe and hardwire. Also included are aluminum coated wire and aluminum coated iron and steel articles as well as terne-alloy-coated sheets. There are 25 specifications, 6 methods of test, and 3 recommended practices.

Those concerned with coated metallic products, corrosion and maintenance will find this compilation useful in their work.

Marine Atmosphere Exposure of Galvanic Couples Involving Magnesium—STP 255. 28 pages, Heavy Paper Cover. AES Nonmembers $2.25, AES Members $2.05.

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This publication reports the results of exposure tests of protective systems for magnesium including chromate conversion, anodic coatings, as well as paint systems of chromate primer and alkyd, phenolic and epoxy enamels. Suitable controls were included in the experiment and inorganic and organic protection for the cathode metals also were studied.

Procedures for Electroplating Coatings on Refractory Metals. (Defense Metals Information Center Memorandum 35) October 1959, 26 pages. (Order PB 161185 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., 50 cents.)

A description of procedures used to electroplate various metals onto the refractory metals.

Development of a Method to Accomplish Aluminum Deposition by Gas Plating. M. J. Hiler and W. C. Jenkin, Commonwealth Engineering Company of Ohio for Wright Air Development Center, U. S. Air Force. June 1959. 64 pages. (Order PB 151923 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., $1.75.)

The deposition of aluminum was achieved by thermally decomposing vapors of tri-isobutyl aluminum on the surface of cleaned, heated copper test panels in a heated plating chamber. Test panels were subjected to a preliminary deoxidation by induction heating to 800F in a hydrogen atmosphere. The test chamber was purged with argon gas as the sample was cooled to 500 degrees. A mixture of gases containing tri-isobutyl aluminum vapors was then admitted for varying periods. The plate produced was substantially pure aluminum. It was lustrous and ductile, showed excellent conductivity, and was 4.7 mils thick. Adhesion varied from poor to excellent.

Evaluation of Protective Coatings for Molybdenum Nozzle Guide Vanes. 1st Lt. J. R. Giancola, USAF, Materials Laboratory, Wright Air Development Center, U. S. Air Force. June 1959. 47 pages. (Order PB 151912 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., $1.25.)

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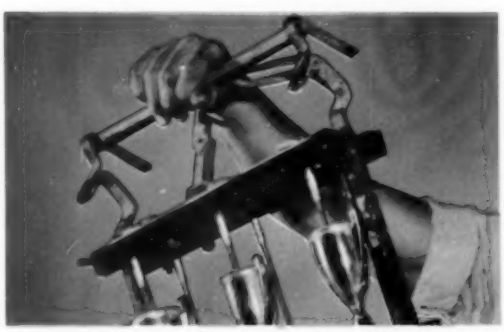

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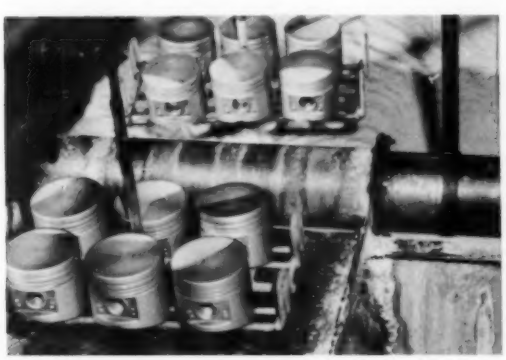

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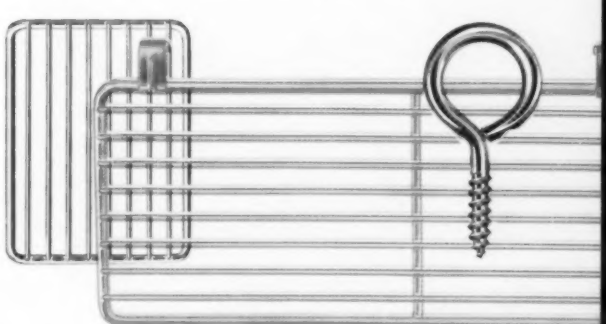

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OXIDATION CHARACTERISTICS OF TIN-PLATING ELECTROLYTES

by J. A. McCARTHY*

Abstract

Various tin-plating electrolytes were subjected to a controlled stream of pure oxygen and the degrees of oxidation were measured and compared. The data indicate that there is a wide difference in tendency of the electrolytes to oxidize and that oxidation of stannous to stannic tin could be a serious problem with some electrolytes under certain operating conditions. The low-sulfate phenolsulfonic acid electrolyte showed least oxidation. Other tin-plating electrolytes studied were chloride-fluoride, fluoborate, high-sulfate phenolsulfonic acid, pyrophosphate, sulfamic acid, and sulfuric acid.

INTRODUCTION

TIN-PLATING ELECTROLYTES based upon stannous tin have a general tendency for some of the stannous ion to oxidize to stannic ion, insoluble stannic salts, or both. When such oxidation proceeds beyond a certain minimum, it has undesirable consequences. The two chief resultant difficulties are that (a) stannous tin concentrations cannot be maintained through anode dissolution alone, and (b) in some electrolytes, plate quality deteriorates as a result of stannic tin held in solution.

The original purpose of the investigation described in this paper was to compare the oxidation susceptibility of the phenolsulfonic acid and the sulfuric acid tin-plating electrolytes, and to determine the effect of sulfate concentration and of tartaric acid on the production of oxidation sludge from the phenolsulfonic acid electrolyte.

The experiment was then expanded to compare the oxidation tendencies of other tin-plating baths, namely, the chloride-fluoride, fluoborate, pyrophosphate, and sulfamate baths.

EXPERIMENTAL METHOD

Series I

In the initial tests (Series I), four electrolytes of the compositions and concentrations listed in Table I were made up. No addition agents were added to any of these electrolytes because the addition agent normally used in the phenolsulfonate electrolyte tends to partially crystallize from solution at room temperature, a tendency that would interfere with the measurement of the quantity of sludge produced by oxygenation. Also, it was desired to study the oxidation tendency of the basic compositions, uninfluenced by the possible effect of any addition agents. Bath A is a typical sulfuric acid tin-plating electrolyte, and Bath C is based on a formulation widely used in high-speed electrolytic tinning lines.[1] Baths C and D contain tartaric acid.

Four 1-liter beakers containing 500 milliliters (ml) of each solution were immersed in a water bath maintained at a constant temperature of 130 ± 2F. Glass tubes were immersed below the surface of the solutions, and the upper ends of the tubes were attached to an oxygen cylinder. The experimental apparatus is shown in Fig. 1. Oxygen flow was adjusted to a rate of about 4 bubbles per second in each beaker. The flow into the beakers was adjusted periodically by changing the immersion depths of the tubes to ensure that each solution was obtaining substantially the same amount of oxygen. Solution level was maintained by periodic additions of distilled water.

After the oxygen had flowed for 4¾ hours, the beakers were removed from the water bath and allowed to cool. Distilled water was added to bring the solutions up to the original level, after which they were thoroughly stirred, and a sample of each was centrifuged. Samples were taken from the supernatant liquid for analyses of stannous tin and total tin. The remainder of each electrolyte was centrifuged until all residue from each bath had been accumulated. The residues were then washed by suspending twice in distilled water and recovered by centrifuging.

The residues were then transferred to evaporating dishes, dried in an oven at 90C for 24 hours or longer, and weighed. The residues were then analyzed for tin content.

Series II

Plating-bath compositions for the Series II experiments are shown in Table II. The fluoborate bath composition (Bath G) is one formulated for high-speed strip tin plating. The sulfamic acid bath (Bath H) was based upon a formula developed by R. F. Higgs and C. J. Owen.[2] The alkaline stannate bath (Bath F) was based upon the common commercial still-plating formula.

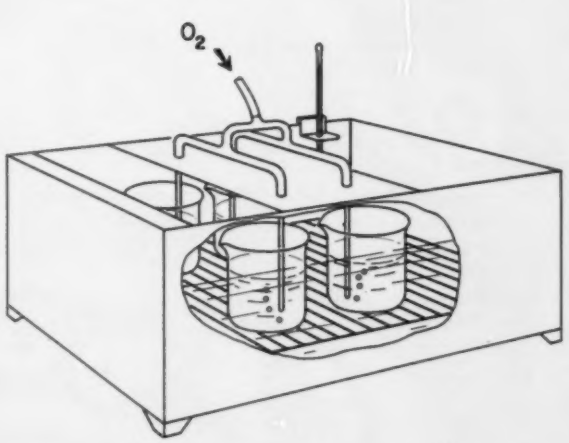

Fig. 1. Experimental apparatus for oxidation of tin-plating electrolytes.

*Applied Research Laboratory, United States Steel Corporation, Monroeville, Pennsylvania.

As in Series I, all addition agents were omitted. This experiment was conducted exactly as in Series I except that oxygen flowed through the solutions for 6½ hours.

Series III

The plating solutions for the Series III tests were made up as indicated in Table III.

The low-sulfate bath (Bath K) was prepared by dissolving tin anodically in phenolsulfonic acid by the porous-pot method. The formula for the chloride-fluoride bath (Bath L) was essentially that of the so-called Halogen process.[3] The experiment was conducted exactly as in Series I, except that the time of oxygen flow consisted of two 6-hour periods with a 17-hour interval between them.

Series IV

The plating solutions for the Series IV tests were made up as indicated in Table IV. Preliminary experiments had indicated that the stannous pyrophosphate electrolyte was highly susceptible to oxidation. Therefore, this experiment was intended to compare the oxidation rate of the pyrophosphate bath (Bath P) with that of the high-sulfate phenolsulfonate control bath (Bath N), and in addition to explore the effect of Rochelle salts (Bath Q) and of dextrin (Bath R) on the oxidation rate of the pyrophosphate bath.

The pyrophosphate bath is based on a recent formula,[4] except that potassium pyrophosphate has been substituted for sodium pyrophosphate, and gelatin has not been used as an addition agent.

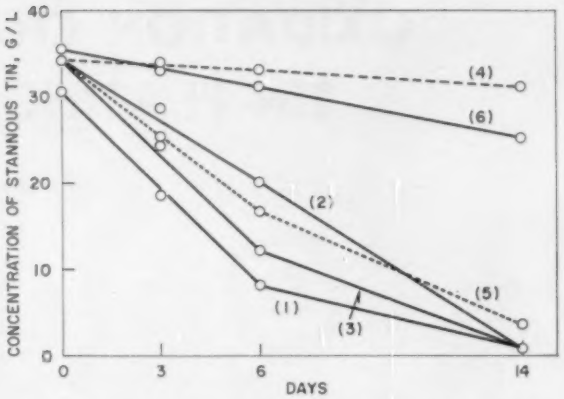

Fig. 2. Static oxidation rate of pyrophosphate electrolytes (Series V).
(1) $Sn_2P_2O_7$, 60 g/l; $K_4P_2O_7$, 100 g/l
(2) $Sn_2P_2O_7$, 60 g/l; $K_4P_2O_7$, 200 g/l
(3) $Sn_2P_2O_7$, 60 g/l; $K_4P_2O_7$, 300 g/l
(4) No. 2 plus 10 g/l of Dextrin
(5) No. 2 plus 30 g/l of Rochelle Salts
(6) No. 2 plus 15 g/l of disodium EDTA

Each of the electrolytes listed in Table IV was made up in 3½-liter batches, filtered, and analyzed. Four 1500-ml beakers containing exactly 1 liter of each of the baths were immersed in a water bath maintained at 140 ± 2 F. The baths were oxygenated for 6 hours by the method described in previous Series I.

TABLE I

Series I

Item	Plating-Solution Composition	Bath A Sulfuric Acid	Bath B High Sulfate Phenol-sulfonic Acid (PSA)	Bath C Bath A Plus Tartaric Acid	Bath D Bath B Plus Tartaric Acid
	Bath Make-Up				
	Stannous sulfate, g/l	65	65	65	65
	Sulfuric acid, g/l	70	..	70	..
	65% Phenoldulfonic acid, ml/l	..	76	..	76
	Tartaric acid, g/l	..	..	30	30
	Concentrations Prior to Oxidation				
1.	Stannous tin, g/l	35.4	34.2	35.5	32.4
2.	Stannic tin, g/l	0.5	0.5	0.4	0.4
3.	Total tin, g/l	35.9	34.7	35.9	32.8
4.	Free acid as H_2SO_4, g/l	70	20	70	20
5.	Total sulfate as H_2SO_4, g/l	106	32	106	32
	Concentrations After Oxidation for 4¾ Hours				
6.	Stannous tin, g/l	31.0	29.9	28.0	28.7
7.	Stannic tin, g/l	0.9	0.5	7.1	4.3
8.	Total tin in solution, g/l	31.9	30.4	35.1	33.0
9.	Weight of dry sludge, g/500 ml	2.89	3.02	0.07	0.17
10.	Tin in sludge, %	59.7	68.1	—	—
11.	Weight of tin in sludge, g/l	3.5	4.1	—	—
12.	Total tin (8 plus 11), g/l	35.4	34.5	35.1	33.0
13.	Missing tin (3 minus 12), g/l	0.5	0.2	0.8	(0.2)*
14.	Loss of stannous tin (1 minus 6), g/l	4.4	4.3	7.5	3.7

*Extra tin.

TABLE II
Series II

Item	Plating-Solution Composition	Bath E High-Sulfate PSA	Bath F Alkaline Stannate	Bath G Fluoborate	Bath H Sulfamic Acid
	Bath Make-Up				
	Stannous sulfate, g/l	65	—	—	55
	65% Phenolsulfonic acid, ml/l	76	—	—	—
	Sodium stannate, g/l	—	105	—	—
	Sodium hydroxide, g/l	—	9.4	—	—
	47% Stannous fluoborate, ml/l	—	—	120	—
	49% Fluoboric acid, ml/l	—	—	30	—
	Sulfamic acid, g/l	—	—	—	50
	Concentrations Prior to Oxidation				
1.	Stannous tin, g/l	34.5	0.0	33.3	29.6
2.	Stannic tin, g/l	0.5	46.7	0.6	0.4
3.	Total tin, g/l	35.0	46.7	33.9	30.0
4.	Free acid as H_2SO_4, g/l	20	—	—	—
5.	Total sulfate as H_2SO_4, g/l	32	—	—	—
	Concentrations After Oxidation for 6½ Hours				
6.	Stannous tin, g/l	30.5	0.0	19.2	20.3
7.	Stannic tin, g/l	0.5	46.7	10.5	0.4
8.	Total tin in solution, g/l	31.0	46.7	29.7	20.7
9.	Weight of dry sludge, g/500 ml	3.20	0.20	3.27	6.58
10.	Tin in sludge, %	65.5	—	66.8	67.9
11.	Weight of tin in sludge, g/l	4.2	—	4.4	8.9
12.	Total tin (8 plus 11), g/l	35.2	46.7	34.1	29.6
13.	Missing tin (3 minus 12), g/l	(0.2)*	0.0	(0.2)*	0.4
14.	Loss of stannous tin (1 minus 6), g/l	4.0	0.0	14.1	9.3

*Extra tin.

Oxygenation was repeated twice by using new 1-liter samples of the original electrolytes, electrolyte temperature being maintained at 170F for the second run and at 200F for the third run. The oxygenation period for each run was 6 hours.

Series V

To compare the oxidation rate of pyrophosphate-base baths under still conditions in air, 250-ml portions of the electrolytes with the nominal compositions listed in Fig. 2 were allowed to stand at room temperature for 3 days in closed flasks and then analyzed for loss of stannous tin. The electrolytes were then allowed to stand in open beakers for 14 days, and were analyzed periodically for loss of stannous tin, evaporation losses being replenished by water additions during this period.

SULFURIC ACID AND HIGH-SULFATE PHENOLSULFONATE BATHS

The Series I solutions were examined after the oxygenation period, and the following observations were made:

Sulfuric Acid Bath (Bath A)—About ½ inch of yellow sediment was deposited in the beaker. The solution was almost clear.

High-Sulfate PSA Bath (Bath B)—About ½ inch of white sediment was deposited in the beaker. The solution was more turbid than Bath A.

Sulfuric Acid Plus Tartaric Acid Bath (Bath C)—No apparent sediment was deposited. The solution was bright yellow-green and turbid.

High-Sulfate PSA Plus Tartaric Acid Bath (Bath D)—A small amount of white sediment was deposited in the beaker. The solution was clear.

Examination of the analytical data in Table I reveals that the oxidation characteristics of the high-sulfate PSA bath (Bath B) and the sulfuric acid bath (Bath A) appear to be approximately equal, Items 9 and 14. The PSA bath produced a little more residue than the sulfuric acid bath; however, the sulfuric acid held slightly more stannic tin in solution than the PSA bath, Item 7.

The use of 30 grams per liter (g/l) of tartaric acid in Baths C and D substantially prevented the formation of oxidation sludge during the ozygenation period, Item 9. However, the apparent advantage of using tartaric acid to reduce sludge formation was negated because of increased formation and retention of stannic tin in the electrolytes, Item 7. This effect occurred for both the sulfuric acid and PSA baths, although the loss of stannous tin in the electrolyte was greater in the sulfuric acid than in the PSA bath, Item 14. Although it has not been conclusively proved, the presence of large amounts (above 2 g/l) of stannic tin in the PSA electrolyte may contribute to poor appearance of tin plate and to lowered efficiency of the plating process.

OXIDATION IN FLUOBORATE AND SULFAMATE BATHS

The Series II solutions were examined after the oxygenation period, and the following observations were made:

High-Sulfate PSA Bath (Bath E)—Turbid and pale yellow, with about ¼ inch of sediment in the beaker.

Alkaline Stannate Bath (Bath F)—Clear, ginger-colored, with a small amount of sediment in the beaker.

Fluoborate Bath (Bath G)—Milky and very turbid. Difficult to determine whether sediment was present. During

TABLE III
Series III

Item	Plating-Solution Composition	Bath J Sulfuric Acid	Bath K* Low-Sulfate PSA	Bath L Chloride-Fluoride	Bath M** Bath L Plus Inhibitor
	Bath Make-Up				
	Stannous sulfate, g/l	65	—	—	—
	Sulfuric acid, g/l	70	—	—	—
	Stannous chloride, g/l	—	—	75	75
	Sodium fluoride, g/l	—	—	25	25
	Potassium bifluoride, g/l	—	—	50	50
	Sodium chloride, g/l	—	—	45	45
	Potassium ferricyanide, g/l	—	—	—	0.3
	Concentrations Prior to Oxidation**				
1.	Stannous tin, g/l	33.6	37.6	35.9	35.9
2.	Stannic tin, g/l	0.6	0.5	1.0	1.0
3.	Total tin, g/l	34.2	38.1	36.9	36.9
4.	Free acid as H_2SO_4, g/l	70	21.1	—	—
5.	Total sulfate as H_2SO_4, g/l	106	7.3	—	—
	Concentrations After Oxidation for 12 Hours				
6.	Stannous tin, g/l	27.7	35.1	19.2	23.3
7.	Stannic tin, g/l	1.2	0.5	9.9	7.7
8.	Total tin in solution, g/l	28.9	35.6	29.1	30.9
9.	Weight of dry sludge, g/500 ml	3.78	1.69	3.38	4.98
10.	Tin in sludge, %	56.5	60.0	28.9	35.5
11.	Weight of tin in sludge, g/l	4.3	2.0	2.0	3.6
12.	Total tin (8 plus 11), g/l	33.2	37.6	31.1	34.5
13.	Missing tin (3 minus 12), g/l	1.0	0.5	5.8	2.4
14.	Loss of stannous tin (1 minus 6), g/l	5.9	2.5	16.7	12.6

*Made by anodically dissolving tin in PSA.
**The pH of Baths L and M was 3.2.

the entire course of oxygenation, the fluoborate bath remained crystal clear, and no precipitate was evident. The turbidity was not noted until after the bath had stood for 16 hours.

Sulfamic Acid Bath (Bath H)—Turbid and very pale yellow, with about $\frac{3}{8}$ inch of sediment.

Examination of the analytical data in Table II reveals that of the three acid baths (PSA, fluoborate, and sulfamate) the PSA bath showed the greatest resistance to oxidation, Item 14. As expected, negligible sludge, Item 9, was produced in the alkaline stannate bath because the tin is normally in the quadrivalent state and cannot be oxidized to any higher state. The stannate bath was included in this experiment to test the assumption that oxygen is not an important cause of the appreciable sludging which occurs in this bath in commercial usage. Carbon dioxide in the air is believed to be a major contributing factor to sludge production in the stannate bath.

The fluoborate bath lost more than three times as much stannous tin as the PSA bath and 50 per cent more than the sulfamate bath, Item 14. More than two-thirds of this stannous tin loss remained held in solution as stannic tin, Item 7; therefore, sludge production, Item 9, in the fluoborate bath was no greater than in the PSA bath. Apparently, little or no oxidation sludge is produced from the fluoborate bath until the electrolyte can no longer retain the large quantity of stannic tin that has been produced. When precipitation does commence, it proceeds rapidly although the precipitate does not settle well.

About twice as much sludge was produced from the sulfamic acid bath as from either the PSA bath or the fluoborate bath, Item 9; however, the stannic tin held in solution in the sulfamic acid bath was no greater than that in the PSA bath though considerably less than that in the fluoborate bath, Item 7.

The sludges produced from all the Series II acid baths were pale yellow and contained approximately the same tin content (65.5 to 67.9 per cent), Item 10. These findings suggest that the major sludge product is probably the same in all three baths.

LOW-SULFATE PHENOLSULFONIC ACID BATH

In the Series III experiments, the main purpose was to determine whether a PSA bath having low total sulfate (because of extensive bath use) will sludge less than a new PSA bath, which has a high total-sulfate content. By using the porous-pot method to prepare the low-sulfate bath, the only sulfate present is that contributed by the sulfuric acid (H_2SO_4) contaminant in the phenolsulfonic acid. The sulfate content of Bath K was 7.3 g/l as H_2SO_4. The sulfate content of the PSA baths made in the conventional manner with stannous sulfate (Baths B and E) was 32 g/l as H_2SO_4.

Examination of the analytical data in Table III reveals that the PSA bath with low sulfate content (Bath K) produced substantially less sludge, Item 9, than the sulfuric acid bath (Bath J) or the high-sulfate PSA bath (Bath E, Table II). These results indicate that PSA does offer an advantage over sulfuric acid in so far as oxidation sludging is concerned, but that this advantage is not apparent until a high-sulfate PSA bath has been used sufficiently long to reduce the sulfate content. The advantage of a low sulfate content in the PSA bath is that such a bath is substantially less susceptible to oxidation. The low-sulfate PSA bath was oxidized substantially less than any other acid tin-plating bath tested, Item 14.

A comparison of the amount of sludge in the two sulfuric acid baths tested (Bath A, Table I, and Bath J, Table III) shows that only about 30 per cent more sludge was produced in Bath J, Item 9, even though the oxidation period for Bath J was 2½ times that of Bath A. This behavior may be due to the establishment of an equilibrium between stannous and stannic tin in solution.

CHLORIDE-FLUORIDE BATHS

The chloride-fluoride baths (Baths L and M) were tested to compare their oxidation characteristics with the other baths of Series III and with the baths of Series I and II. Bath M contained 0.3 g/l of potassium ferricyanide, a material that has been recommended as an inhibitor to reduce tin oxidation by precipitating iron and copper from the solution. These two cations are regarded as accelerators of oxidation in the chloride-fluoride bath.

The oxidation period was extended in this series because the two chloride-fluoride solutions did not appear to be sludging more than a slight amount after the first six hours. It was later learned that a deposit had been produced, but that its crystalline nature and its tight adherence to the walls and bottom of the beaker gave a deceptive impression of the quantity present. After the oxidation period, the chloride-fluoride solutions were clearer than the PSA solutions.

The chloride-fluoride baths lost considerably more stannous tin through oxidation than the low-sulfate PSA bath, as shown in Table III, Item 14. The potassium ferricyanide oxidation inhibitor in Bath M appeared to have some effect on reducing oxidation but did not prevent it. Even the inhibited bath suffered a loss five times as great as occurred in the low-sulfate PSA bath.

The chloride-fluoride baths were similar to the fluoborate bath (Bath G) in retaining large amounts of stannic tin in solution, Tables II and III, Item 7.

The oxidation sludge produced by the chloride-fluoride baths was heavier and coarser, and contained a lower percentage of tin, Item 10, than the sludge produced by any of the other acid baths studied. The composition of the sludge from both chloride-fluoride baths was apparently different from that produced in the other electrolytes. The chloride-fluoride electrolyte remained clearer than the others, probably owing to the better settling properties of the sludge. The large amount of missing tin in Baths L and M (Table III, Item 13) is attributed to the fact that part of the extremely adherent residue could not be removed from the beakers.

PYROPHOSPHATE BATHS

In the Series IV experiments, examination of Table IV shows that the oxidation rate of the pyrophosphate baths, Items 8, 13, and 18, is substantially higher than that of the high-sulfate phenolsulfonic acid control.

It may be noted that in the Series IV experiment loss of

TABLE IV
Series IV

Item	Plating-Solution Composition	Bath N High-Sulfate PSA	Bath P Pyro-phosphate	Bath Q Bath P Plus Rochelle Salts	Bath R Bath P Plus Dextrin
	Bath Make-Up				
	Stannous sulfate, g/l	65	—	—	—
	65% Phenolsulfonic acid, ml/l	76	—	—	—
	Dihydroxy diphenyl sulfone, g/l	3	—	—	—
	Stannous pyrophosphate, g/l	—	60	60	60
	Potassium pyrophosphate, g/l	—	200	200	200
	Rochelle salts, g/l	—	—	50	—
	Dextrin g/l	—	—	—	10
	Concentrations Prior to Oxidation				
1.	Stannous tin, g/l	35.5	32.2	32.3	33.4
2.	Stannic tin, g/l	0.2	3.9	3.5	2.8
3.	Total tin, g/l	35.7	36.1	35.8	36.2
	Concentrations After Oxidation at 140 F for 6 Hours				
4.	Stannous tin, g/l	34.3	27.5	25.2	28.7
5.	Stannic tin, g/l	0.3	8.6	10.6	7.5
6.	Total tin, g/l	34.6	36.1	35.8	36.2
7.	Tin in sludge (3 minus 6), g/l	1.1	0.0	0.0	0.0
8.	Loss of stannous tin (1 minus 4), g/l	1.2	4.7	7.1	4.7
	Concentration After Oxidation at 170F for 6 Hours				
9.	Stannous tin, g/l	33.4	25.3	22.5	25.4
10.	Stannic tin, g/l	0.4	10.8	13.3	10.8
11.	Total tin, g/l	33.8	36.1	35.8	36.2
12.	Tin in sludge (3 minus 11), g/l	1.9	0.0	0.0	0.0
13.	Loss of stannous tin (1 minus 9), g/l	2.1	6.9	9.8	8.0
	Concentration After Oxidation at 200F for 6 Hours				
14.	Stannous tin, g/l	33.6	22.0	22.7	26.0
15.	Stannic tin, g/l	0.3	14.1	13.1	10.2
16.	Total tin, g/l	33.9	36.1	35.8	36.2
17.	Tin in sludge (3 minus 16), g/l	1.8	0.0	0.0	0.0
18.	Loss of stannous tin (1 minus 14), g/l	1.9	10.2	9.6	7.4

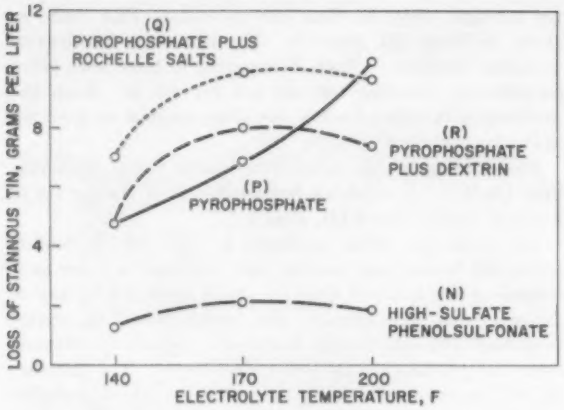

Fig. 3. Effect of temperature on oxidation rate in Pyrophosphate electrolytes (Series IV).

stannous tin in the high-sulfate bath (Bath N) was less than ⅓ that in the Series I or II experiments (compare Item 14, Tables I and II, Baths B and E, with Item 8, Table IV, Bath N). This lower loss of stannous tin in Bath N may be due to the presence of the sulfone addition agent, which may have inhibited oxidation. Another possible explanation for this difference in loss is that the bath samples were twice as large (1 liter) in Series IV than they were in Series I through III, so that substantially identical quantities of oxygen acted upon twice the volume of solution. For these reasons, oxidation rates in Series IV may not be justifiably compared with those in Series I through III.

Table IV shows that within the limits of the present experiment, oxidation of pyrophosphate electrolyte did not produce any oxidation sludge, Items 7, 12, and 17, all oxidized tin being held in solution in the stannic condition.

Figure 3, which is plotted from data in Table IV, shows the effect of temperature on oxidation rate. For all electrolytes, the oxidation rate is higher at 170F than at 140F. The electrolytes did not appear to oxidize more at 200F than at 170F, except for the pyrophosphate electrolyte without addition agent. No ready explanation is available for the seeming difference in behavior of this electrolyte. For the other three electrolytes, the slight decrease in oxidation rate at 200F may be due to lower solubility of oxygen at the higher temperature.

The presence of Rochelle salts did not inhibit the oxidation of stannous tin and may even have accelerated it.

The presence of dextrin may have some tendency to reduce oxidation (it appeared to have reduced it at 200F), but the data are not conclusive.

The Series V experiment was conducted to explore further the oxidation characteristics of the pyrophosphate electrolyte. Plating experiments had indicated that this electrolyte oxidized excessively even at room temperature in air.

After the six solutions listed in Fig. 2 had stood in closed flasks for three days, analyses showed no loss of stannous tin for any of the solutions. The curves in Fig. 2 show the loss in stannous tin (caused by air oxidation) over a 14-day period when the six solutions were exposed to the air in open beakers. The solutions were analyzed after 3, 6, and 14 days. The following conclusions were drawn from these data:

(1) The unmodified pyrophosphate electrolytes are excessively prone to oxidation, stannous tin being completely oxidized to stannic tin within 2 weeks under mild oxidizing conditions involving neither agitation nor heat, Fig. 2, Curves 1, 2, and 3.

(2) Increasing the concentration of potassium pyrophosphate slowed the rate of oxidation somewhat but not enough to be of practical significance. Examination of Curves 2, 4, and 6 indicates that the rate of oxidation is linear and that Curves 1 and 3 would probably have been straight if analyses had been conducted in the interval between 6 and 14 days.

(3) Dextrin was effective in markedly reducing the oxidation rate, the dextrin-containing electrolyte showing a loss of stannous tin of only 10 per cent in 2 weeks as compared with total oxidation of the unmodified electrolytes. Other experiments with a dextrin-containing pyrophosphate electrolyte, however, have shown complete oxidation of stannous tin over a 5-day period when plating was performed intermittently at the normal operating temperature of 160 to 190F.

(4) Disodium EDTA slowed the oxidation rate, but was not as effective as dextrin.

(5) Rochelle salts appeared to have slowed the oxidation rate slightly, but not enough to be of value.

GENERAL CONCLUSIONS

The chief conclusion drawn from this work is that in dealing with tin electrolytes that plate from the stannous condition, the degree to which the stannous ion oxidizes is a critical factor that can determine whether the electrolyte is a useful one.

Stannous electrolytes generally tend to oxidize appreciably. Although the experimental procedures used in this study are not regarded as sufficiently precise or sufficiently complete to confidently rank all these electrolytes in the order of their susceptibility to oxidation, the results are believed to give a reasonably clear indication that, of those electrolytes tested, the low-sulfate phenolsulfonic acid electrolyte is the least susceptible to loss of stannous tin.

All other electrolytes showed a strong tendency to oxidize under strongly oxidizing conditions. However, some might be suitable for prolonged use under mild oxidizing conditions, such as those encountered in still plating. Even under these conditions, it has been demonstrated that the unmodified pyrophosphate electrolyte would be unsuitable. At least some of those electrolytes that have a strong tendency to oxidize (and possibly all of them) can be modified by the addition of suitable antioxidants to become useful electrolytes even under highly oxidizing conditions.

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ADHERENCE OF THICK CHROMIUM DEPOSITS AS AFFECTED BY SURFACE PREPARATION

by J. G. POOR,* H. CHESSIN** and C. L. ALDERUCCIO**

Photomicrographs show that honing, usually considered a relatively mild machining operation, can cause extensive damage to metal surfaces. Machining, grinding, even polishing, can also cause sufficient damage to metal surfaces to affect the bond strength of electrodeposits on these surfaces. Where electrodeposits are liable to severe stresses in service, it is especially important to remove these weakened surfaces before plating.

A CONSIDERABLE AMOUNT of attention is being given to the effects of basis metal preparation on the porosity and roughness of electrodeposits. Little has been added to the definitive work of Steer[1] regarding the adhesion of electrodeposits to mechanically prepared surfaces. This work and the fine metallographic studies of Samuels[2] and Langford[3] have shown that machining (tooling), grinding and polishing can cause changes at and below the surface of a host of metals. These changes and the depth to which these changes are found depend on the physical properties of the metal and the various parameters of the mechanical operation. Whether or not this layer may be termed a Beilby layer is secondary to the fact of its presence and consequent effects on the adherence of deposits electroplated thereon.

During an investigation of the adherence of thick chromium deposits to ductile cast iron we found that honing before plating can lead to poor bond. Honing is usually considered a mild machining process, in comparison either to tooling or grinding, since the speeds of operation and the pressures involved are relatively low. Yet chromium deposits plated on cylinder bores which had been honed in production exhibited poor bond by the "push-out" test.[4] In this test, a blind hole, ¼-inch in diameter, is drilled from the back side of the specimen such that the point of the drill stops about $^{1}/_{32}$–$^{1}/_{16}$ inch short of the chromium plated surface. A hardened rod, slightly smaller in diameter than the drilled hole, is forced through this hole from the back until a button is ruptured from the face of the specimen to leave a through hole. Examination of this button and of the periphery of the hole left in the surface leads to classification of adherence. In cases of poor bond, the chromium may exfoliate from the button and/or from the periphery of the hole in large flakes.

Previous tests in this laboratory had shown that the plating technique was capable of yielding excellent bond. Examination of the flakes of chromium which had spalled from a cylinder with poorly-bonded chromium showed two rather interesting facts: the flakes of chromium were attracted by a magnet and a drop of acidic copper sulfate solution on the

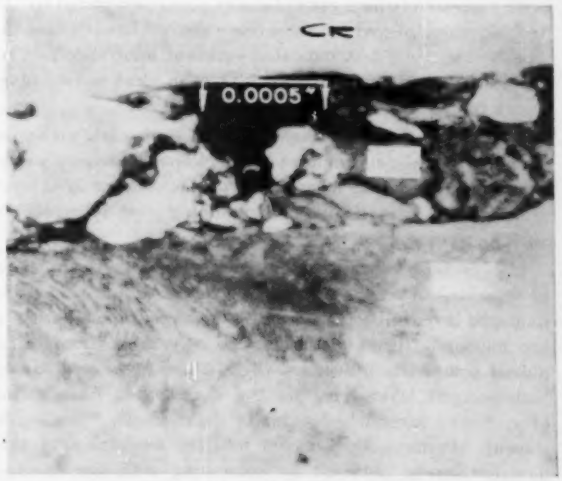

Fig. 1. Ductile iron—P 1327

* Formerly of Van der Horst Corporation of America. Now with Spar-Tan Engineering Co., Los Angeles, Calif.
** Van der Horst Corporation of America, Olean, New York.

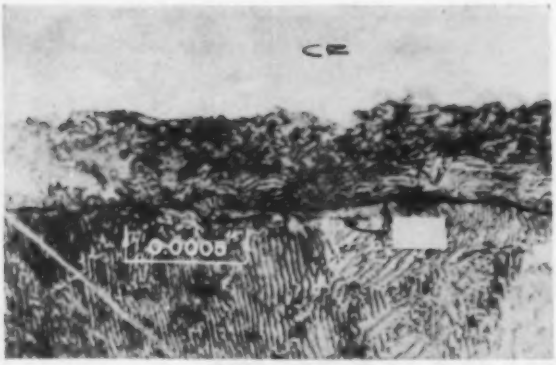

Fig. 2. Gray cast iron—P 1321.

under or basis metal side of these flakes would cause the formation of an immersion deposit of copper. Both these properties, magnetic and chemical, are characteristic of iron not of chromium. This then established that the chromium was relatively well bonded to the iron surface and that separation had occurred in the iron itself rather than at the chromium-iron interface. One might normally consider this to be evidence of excellent adherence but the extent of flaking of the chromium indicated that this separation was too easy and that the cohesion of the surface iron to the iron beneath was indeed poor.

Photomicrographs of cross sections made clear why the bond was poor and where this separation came about. Figure 1 is a cross section showing a heavy chromium plate on honed ductile cast iron. The damage to the iron and the amount of distorted debris between the undistorted cast iron and the chromium above is so evident that no comment is necessary. That this is not peculiar to ductile cast iron or an isolated case is shown in Figs. 2 and 3. These are cross sections of portions of two gray cast iron cylinders which had exhibited exfoliation in service. Several other cylinders which had failed in service were found to exhibit the same or similar patterns, not all being quite so extreme or evident. In each of these cases, evidence of a substantial layer of ferrous material was found on the undersides of the chromium flakes obtained from the "push-out" test.

Several pieces of cast iron were metallographically polished with successively finer grits of emery paper and plated by the techniques employed for these cases above. In each case the "push-out" bond test indicated excellent adherence and no flaked chromium was obtained. Thus an ideal surface upon which to plate is shown in Fig. 4.

Further investigation showed that the pre-plate etches as normally used in chromium plating of ferrous materials cannot remove more than a superficial part of this damaged layer and are entirely inadequate for obtaining good adherence on such distorted surfaces.

It is evident from these photomicrographs that exfoliation of deposits can occur because of parting within or below this damaged layer of basis metal. Depending on the severity of the machining process, the surface may range from being almost completely pulverized (Figs. 1 and 3) to a relatively homogeneous layer lying on the undisturbed basis metal (Fig. 2) to a layer which exhibits slight plastic "flow" (not shown). Perhaps some insight into the mechanism of this damage can be obtained by comparing with the damage caused by hardness-testing penetrators. Similar effects have been discussed by Tabor[5] in connection with hardness measurements. He illustrates the work of Davies[6] regarding elastic deformation of a flat surface by a sphere. It is found that the shear stress is not a maximum at the surface of contact but rather appears at a depth below the center of contact and this depth is equal to one-half the radius of the circle of contact. Further, plastic deformation commences in this region when the mean pressure is approximately equal to 1.1 times the yield stress of the metal.

We may thus assume that parting lines as evidenced in the photomicrographs would not be unusual in any machining process where the mean orthogonal pressure of the contacting tool bit (or abrasive particle) exceeds the yield stress of the metal. The fact that the damaged layer may exhibit a structure parallel to the surface may be explained by the parallel traverse of the machining elements.

In passing it is interesting to note that chromium has apparently plated well into the pulverized layers thus exhibiting surprising "micro-throwing power" in contrast to the notoriously poor macro-throwing power of chromium under normal plating conditions.

Although these photomicrographs are only of cast irons, like damage is caused by severe mechanical treatments of other basis metals as well (see Samuels and Langford, loc. cit.). Our own tests on machined chromium plated steels have shown the presence of ferrous material on the under side of the poorly adherent chromium plated by techniques capable of producing excellent adherence to properly treated steel surfaces. There is little doubt that others have suffered poor adherence from poorly adherent steel layers. Schmitt[7] states, "... chromium plate will not adhere if the steel surface has been locally overheated for a short time because of inattention during grinding." During the last war, this laboratory investigated the chromium plating of machine gun barrels. It was found that electropolishing of the steel before chromium plating increased the deposit's adherence. In retrospect, it is easily understood that the broaching operations to form the gun bores caused surface damage and that this weakened layer had to be removed prior to plating to provide a strong basis metal for the chromium.

Other metals are even more readily damaged than cast iron or steel. Aluminum and copper will smear readily. We

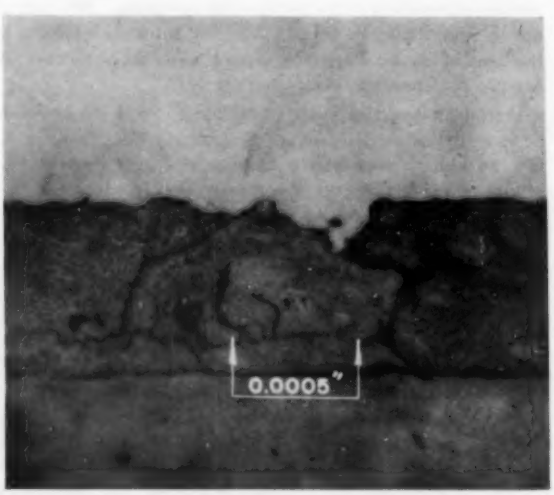

Fig. 3. Gray cast iron—P 1314.

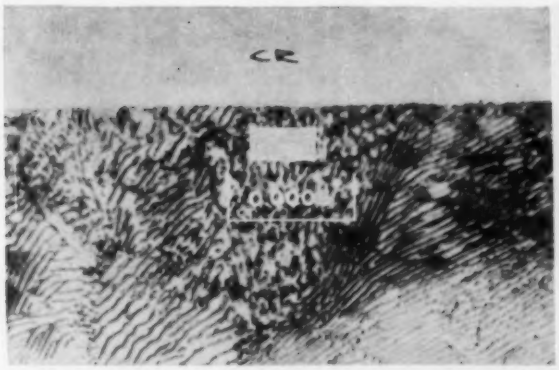

Fig. 4. Gray cast iron metallographically polished—P 1319.

have plated on both machined and buffed copper and aluminum surfaces with resultant poor adherence. This can be prevented by etching, chemical- or electropolishing. Missel[8] has found that buffing and polishing lead to inferior adhesion of nickel to copper whereas sanding with 600 grit emery paper increases adhesion.

In plating practice it is necessary to remove the damaged surface layer on the basis metal which has resulted from any mechanical surface-working operation to obtain good adherence of electrodeposits. This is particularly important for deposits which will encounter severe mechanical stresses in service. For metals such as steel, copper or aluminum which may readily be chemically polished or electropolished or smoothly etched in depth, the remedy is obvious. Cast iron is not so easily electropolished in a practical manner and the damaged layer is often best removed by mechanical techniques which simulate metallographic polishing such as superfinishing.

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John G. Poor joined the Van der Horst Corp. of America as plating chemist in 1943 and was appointed director of research in 1948. Mr. Poor's first laboratory experience was gained while with the General Electric Co. for a five year period. He was employed for ten years as plating chemist at the Underwood Corp. Research Laboratory. In addition to Mr. Poor's extensive work in porous chromium plating, he has done considerable work in electrolytic iron. He accepted his present position as plant manager, Spar-Tan Engineering Co., Los Angeles, California in 1958. He is a member of the AES and the Electrochemical Society.

Dr. Hyman Chessin was born in Cleveland, Ohio in 1920. Graduate work in electrodeposition and electrochemistry at Western Reserve University, Cleveland, Ohio, led to the PhD degree in physical chemistry in 1951. Teaching and research in electrodeposition at Kenyon College, Gambier, Ohio, and research at the Institute of Science and Technology, University of Arkansas, Fayetteville, Arkansas was followed by the appointment in 1954 as assistant director of research for the Van der Horst Corp. of America, Olean, New York. Dr. Chessin was appointed to his present position as director of research in 1958. Dr. Chessin is a member of the AES, the ACS, the Electrochemical Society, the Electrodepositors' Technical Society, London, the ASTM Committee B-8 on Electrodeposited Metallic Coatings, Sigma Xi and Sigma Pi Sigma.

C. Lee Alderuccio joined the Van der Horst Corp. of America in 1954 as a research electrochemist, having received the MS degree from St. Bonaventure University in 1950. He was appointed to the post of assistant director of research and development in 1958. Mr. Alderuccio is currently employed at the Solvay Process Division of Allied Chemical Corp. in Syracuse, N. Y. as a plating consultant.

A corner of the classroom filled with students interested in increasing their knowledge of plating.

Dr. J. R. Mickelsen lecturing on anodizing of aluminum.

A METHOD FOR CONDUCTING AN ELECTROPLATING COURSE

by A. EVERETT COOK*

This paper presents a typical course to educate the industrial plater in the scientific aspects of his profession. It demonstrates the action taken and how pursued by a local AES Branch to improve the knowledge of the men involved. Included are lectures on cleaning, plating baths presently in use, precious metals, electroless plating, and the anodizing of aluminum.

This information was compiled from the lectures given by Dr. J. R. Mickelsen, Portland State College, at the special school on Industrial Electrochemistry. Information is given on how the course was established, how the material studied was selected, the textbooks used, and the results received after the course was over.

INTRODUCTION

FOR MANY YEARS, electroplating consisted of closely-guarded secrets, handed down from the master to his apprentice. It is now believed that this art had its origin in ancient Egypt about 3000 BC, although the method used is lost to the modern world. Gold and gold alloys were the metals principally in use. Evidence has recently been uncovered indicating that copper plating had been known—of an immersion nature—during the height of the Inca Indian period.

Science appeared in this field with the advent of Volta (1745–1827), an Italian physicist, and Faraday (1791–1867), an English scientist. Volta made the first electrolytic cell and Faraday was responsible for the first laws of electrochemistry concerning electrodeposition. Physical chemists have since endeavored to develop this field of electrochemistry and its allied sections throughout time to this present date. It has been through this research that many new types of electroplating have been developed—alloy plating, vacuum plating, organic media, non-aqueous baths, and the use of brighteners.

However, the merger of these two areas of plating—practical and theoretical—has not been complete. This is partly due to the difficulty in converting theoretical science into practical applications—the understanding of chromium plating and many others—mostly, because of the lack of scientific knowledge by the practical plater. He is often unable to apply new methods due to this limited knowledge of the scientific mechanics of the modern baths and their applications. It would also appear that the plater must accept the word of others, or depend upon the integrity of the industrial salesman in order to stay in business. To improve the situation the plater should be well-versed in the electrochemical aspects of his field. It is to this end that this educational course was provided for the local platers and other interested personnel.

ESTABLISHMENT OF PLATING SCHOOL

The author became acquainted with the American Elec-

* Chief Production Chemist, Tektronix, Inc., Beaverton, Oregon

troplaters' Society through attending the first Electroplating School held by the Portland Branch last year. Being employed as a research chemical engineer, brought into view quite a few problems in metal finishing and much was learned at the school. It was during this course that the author joined the AES and was placed on a newly-formed Educational Committee. The objectives of this committee were to rectify the short-comings of the first course and to attempt to better the course for the next year.

The largest problem involved the creation of a better understanding of the chemical teachings by the less formal education of the men concerned. To this end, three men with varied backgrounds, held numerous sessions throughout the summer months. Mr. Robert Finzer, an experienced plater, Dr. John Mickelsen, professor of physical chemistry at Portland State College, and the author, an industrial chemist, tried to ascertain the requirements of the local platers and how best to satisfy these needs. Bob Finzer presented the typical problems that confront platers, and the author supplied the line of theory intended to correlate the practical work with the theoretical explanation. A program was specifically formulated to cover the needs of the various local plating shops. Problems involving cleaning treatments, different types of plating, waste control and recovery, and "trouble-shooting," were of prime interest.

After a general curriculum was established, the next problem was the selection of a textbook. A textbook could furnish a source of information and questions for the classes, and should provide an impetus for more active study.

The physical chemistry type of books were immediately eliminated due to the lack of prerequisite education in theoretical chemistry among the interested personnel. The main choices included: *Electroplating Engineering Handbook*, by Graham; *Principles of Electroforming and Electroplating*, by Blum and Hogaboom; and *Electroplating*, by Mohler and Sedusky. It was of major concern that the textbook be concise and complete, yet be of a caliber entirely understood by the professional plater. With careful consideration, *Electroplating*, by Mohler and Sedusky was chosen. This book filled the requirements and offered a guide for the men to follow. The other books were recommended for further studies and to be used as auxiliary textbooks. The author advised the study of all of these books, along with the *Metal Finishing Guidebook*, in order to gain proficiency in the plating field.

The planned list of studies to be pursued was consolidated into 15 sessions. It was decided to hold only one class a week in order to maintain the highest interest and not to inconvenience the attending students. The course was to be presented on an evening best suited for most of the men and not to exceed a two-hour period per class. At a local AES Branch meeting, much enthusiasm was shown for the new course. It was agreed that the classes should be held on Monday evenings. The Portland Branch was again fortunate in obtaining the facilities of the Portland Extension Center of the Oregon State System of Higher Education in Portland, Oregon. Their Administration Department also printed brochures (Fig. 1) announcing the offered course. These were sent to the various plating shops, industrial laboratories, and other interested firms. This information was followed by telephone calls to the recipients to keep the availability of the course well in mind. On the afternoon of the first class, the telephone calls were repeated.

In order to underwrite the expenses incurred at the school, the AES Portland Branch had to guarantee the sum of $400. If the individual fee were set at $1.00 per session, or $15 for the course, the minimum number attending would necessarily be 27 to meet the cost of the course. The first evening's attendance was 39, composed of men representing all phases of the local industries.

THE CURRICULUM

Dr. Mickelsen began the lectures with an explanation of the fundamental properties of matter. Definitions were made clear on mixtures, compounds and elements. Much time was spent on the understanding of valency, since this is the foundation of all electroplating. For example, as copper is plated out of a copper sulfate solution by the energy supplied through the introduction of electrical power, it leaves behind the active sulfate part of the solution. This, in turn, reacts with the copper ions dissolved from the anode to form copper sulfate to stabilize the solution. Chemically, the reaction is:

(a) $CuSO_4$ (copper sulfate) + 2 e (electrical energy) = Cu (deposited copper) + SO^{-}_{4} (ions)

(b) Cu (anodes) − 2 e = Cu^{++} (ions)
$Cu^{++} + SO^{-}_{4} = CuSO_4$ (balanced solution)

Basically, this general type of reaction occurs in all plating baths. It is compounded by complexing agents, side reactions, and other additions used to produce the desired finish. The valence number is the number of electrons (shown as either a positive or negative number) that each element loses or gains as the reaction takes place. Assuming an efficiency of 100 per cent and applying 1608.4 amp-minutes of electricity, one gram equivalent weight of metal will be deposited on the cathode. One gram equivalent weight is equal to the atomic weight of the metal divided by its valence. Thus, the amount of metal deposited can be calculated by knowing three things—valence, atomic weight, and the amount of electricity used in a given length of time.

The composition of the bath must have four requirements. The bath itself must be an electrolyte, which means that it must be capable of supplying ions for the flow of electricity. The anode (positive cell) must be either soluble, dissolving the metal ions in the solution—or insoluble, permitting the flow of electricity only. The cathode is the conductive material to be plated and it completes the electrical circuit. The final need is the source of electricity (potential) for the flow of electrons through the completed circuit.

Other factors relating to the plating bath include metals of more than one valence, temperature of the solution (in general, the higher the temperature, the easier the flow of electrons), the degree of agitation—using either the air or mechanical system, the concentration of the solution (higher concentrations allowing faster plating), and the role of efficiency where lower efficiencies require longer amounts of time to plate the same thickness of metal. Reviewing these factors to a finer degree, it is found that using polyvalent elements such as gold (Au^{+1}, Au^{+3}), chromium (Cr^{+3}, Cr^{+6}), copper (Cu^{+1}, Cu^{+2}), Iron (Fe^{+2}, Fe^{+3}) or tin (Sn^{+2}, Sn^{+4}), makes it very important to use the correct valence of the metal in preparing a bath. For example, in an acid tin bath, stannous (Sn^{+2}) sulfate must be used, as stannic (Sn^{+4}) sulfate has a low solubility and will precipitate out of solution. Increasing the temperature will permit higher solubilities, decrease the amount of "drag-out", increase the conductivity while increasing the size of the metallic crystals, and reduce the absorption of gases that cause embrittlement and fractures. Agitation will increase the availability of fresh metal ions at

A Special Course in

INDUSTRIAL ELECTROCHEMISTRY

This special course is designed for those desiring a good background in the practical fundamentals of electrochemistry, as applied to the growing electroplating industry. It should be especially beneficial to persons actually working in plating operations.

This special course is divided into Sessions I and II. Industrial Electrochemistry I will be held starting November 2 and ending December 14, 1959. After a break over the holiday period, Industrial Electrochemistry II will begin January 4 and end February 22, 1960. Sessions I and II will be taken as one course.

The topics covered in Session I will include the following:

- Elementary principles of chemistry including electrochemistry
- Factors and properties that influence electrodeposits
- Constitution of baths -- effective concentration and temperature, solution, and analysis
- Preparation of surfaces for electroplating
- The uses of buffers, wetting agents, and brighteners
- Trouble shooting

The topics covered in Session II will consist of:

- Purification of baths
- Electroless deposits
- Aluminum
- Precious metals
- Waste control
- Metal recovery

The instructor will be Dr. John R. Mickelsen, who taught last year's successful class in basic electrochemistry. Dr. Mickelsen is now teaching chemistry at Portland State College and is well versed in electrochemistry as applied to the electroplating industry.

This course will be held for fifteen Monday evening sessions from 7:00 to 9:00 p. m., starting November 2, 1959, with Session I, and ending February 22, 1960, with Session II. The class will be held in Room 154 of State Hall, which is the new classroom building between Mill and Montgomery on S. W. Broadway.

The registration fee for the special course, consisting of Sessions I and II, will be $15.00. Please make your check payable to the Portland Extension Center and mail to the business office, 1724 S. W. Park Avenue. Please note the name of your class on your check.

To register or for further information, call Mrs. Ruth Straite, CA 6-6601

this course
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Fig. 1. Announcement of the Portland Branch sponsored course

the cathode while removing interfering gas bubbles from the anodes. It may also permit an increase in the current density (amount of electricity used per given area) and will prevent any stratification in electrolyte concentration. However, air agitation has a detrimental effect on cyanide baths because it will oxidize cyanides to carbonates. Excessive agitation can also stir up any bottom sludge, causing coarse plating—which also can be attributed to the detachment of metal particles from the anode due to the agitation.

Higher concentrations provide higher conductivity and a higher cathode efficiency for faster plating. At times, this advantage can be negated by the initial costs, greater "drag-out," and the solidification of the solution at lower or normal temperatures. Low concentrations are quickly exhausted and must be frequently replenished. Efficiency is determined as the per cent of actual plating as compared to the theoretical value. If one faraday of electricity plates out one gram equivalent weight of metal, the cathode efficiency will be 100 per cent. The above-mentioned factors decide the efficiency of the plating baths. Very often, other factors will also affect the cathode efficiency of the bath. These factors include: the degree of ionization of the metal salts and/or the complex salts (such as $KAu(CN)_2$); the amount of polarization, or reverse potential, during the plating that resists the flow of current sometimes due to the formation of film on the anode; and, the degree of throwing power (decreased by eddy currents, shaded areas, recessed areas, and overvoltage).

Much time was spent on this phase of the course, because it was considered to be the foundation of electroplating. Some of the material was re-presented and time was allowed for "question and answer" periods until all of the attending members thoroughly understood the material.

The second phase of the school covered the preparation of the cathode surface and the preliminary plating (or strikes). First to be discussed was the removal of oils and fats that accumulate on the surface of the metal through handling and forming. There are three classes of cleaners in this category. Solvents, which dissolve the contaminants by their organic action, are used either in the liquid state, such as monochloroethane or toluene, or in their vapor state, such as trichloroethylene. Using vapor degreasing, less of the residual gum is left on the metal. This action is due to the surface temperature of the metal being cool enough to condense the vapors and flow off the surface with the grease and oil, leaving fresh solvent on the metal to continue its action. Ultrasonics are now being used with solvents to increase their efficiency by removing trapped microscopic particles through a process known as "cavitation," or high-frequency vibrations that introduce the solvent into the pores.

The second type of cleaner discussed was the emulsion type. These are the water-based compounds whose basic action lowers the surface tension, or tenacity of contaminants for the metal, and then surround the droplets, allowing the grease and oil to be flushed off with water. Their composition generally includes sodium hydroxide, sodium carbonate, sodium phosphate, sodium metasilicate and wetting agents. These solutions can be used either hot or cold, and are the easiest to prepare for limited cleaning.

The final class of cleaners involve the use of electricity. The electrolyte commonly used is the same nature as the basic emulsion cleaner but making the work to be cleaned either anodic (positive) or cathodic (negative). Cathodic cleaning is used on non-ferrous metals, and cleans by scrubbing the work with hydrogen gas, literally ripping off any foreign matter from the surface. There also exists the danger of an hydrogen explosion. Anodic cleaning cleans by scrubbing the work with oxygen, thus removing the surface contaminants and oxidizing many of the metallic impurities. However, there are some limitations involved that must be considered. For example, excessive voltage will sometimes pit the work to be cleaned when using anodic current. Tin, zinc, lead and aluminum are the most susceptible to this condition. Also, the anode occasionally forms a passive film that tends to resist the flow of electrons in the cleaning circuit.

In conjunction with the effects of electrolytic cleaning for the removal of oxides, chemical baths are also used. These baths are called pickling baths and are usually divided into two groups—bright dips and descalers. Bright dips are mostly acidic and are used as the final step before plating in acid type baths to assure a tenacious bond of the plate to the base metal. The descaling solutions are used to remove rust and scale (oxide) before immersion in the bright dip. In the case of cyanide plating, thorough rinsing must be employed in order to avoid contamination of the bath with the acid.

Plating bath make-up was discussed, particularly the types that are in use in this area. Plating baths, of the common aqueous type, can be resolved into four classes—simple inorganic (e.g., $CuSO_4$), complex inorganic (e.g., $CdSiF_6$), simple organic (e.g., Ni $(C_2H_2O_2)_2$), and complex organic (e.g., $KAu(CN)_2$). Starting with the cyanide (CN^{-1}) type of bath, there are several definitions pertaining to the composition that must be explained:

Total cyanide—the amount of active CN^{-1} ions

Total alkali cyanide—the CN^{-1} that is combined with potassium or sodium

Total combined cyanide—the CN^{-1} that is in a complex or straight ion form

Total combined alkali cyanide—the CN^{-1} that is combined with the heavy metals

Free cyanide—the cyanide not consumed by complex agents

Metal cyanides—the cyanide combined with the heavy metals and computed from this complex

Cyanide ratio—the total cyanide divided by the metal cyanide

In a cyanide bath, many reactions can take place. When sodium cyanide (NaCN) reacts with carbon dioxide (CO_2) in the presence of water, hydrogen cyanide (HCN) is evolved—

$$2NaCN + CO_2 + H_2O = Na_2CO_3 + 2HCN\uparrow$$

In order to eliminate this hazard, more NaOH is added to keep the equation to the left. At the anode—if it is operating at a low efficiency—the following reactions can take place:

$$NaOH = Na^+ + OH^-$$
$$2OH^- = H_2O + (O) + 2e$$
$$NaCN + H_2O + NaOH + \tfrac{1}{2}(O) = Na_2CO_3 + NH_3\uparrow$$

If the solution becomes heated over 50C, the possibility that HCN may be evolved is greatly increased:

$$NaCN + H_2O = NaOH + HCN\uparrow$$

The carbonates may be removed either by lowering the temperature to 26F and decanting the liquid, leaving the solidified Na_2CO_3; or "salting" with barium hydroxide ($Ba(OH)_2$) or calcium hydroxide ($Ca(OH)_2$) to precipitate the insoluble carbonates.

The first plating bath discussed was the cadmium cyanide bath. The cyanide type of bath is used to give greater throwing power by increasing the polarization effect at the cathodic high current density areas. The equation for the cadmium-cyanide complex is:

$$CdO + 3NaCN + H_2O = Cd(CN)_2 + 2NaCN + NaOH = NaCd(CN)_3 + 2NaOH$$

High concentrations—on the order of 6:1 CN:Cd—of cadmium and cyanide permit higher throwing power, lower carbonate formation, and efficiencies in the 90–95 per cent range. Using undercoatings such as tin will tend to increase the corrosion resistance of the plated finish. However, tin should not be allowed to dissolve in the cadmium bath, as it will act as a contaminant, resulting in a rough, dull finish. Other contaminating metals are thallium, lead, antimony, arsenic and silver. These can often be eliminated by adding cadmium "sponge" to the bath, precipitating the contaminating elements and then filtering the solution.

The second bath discussed was the chromium bath. The metal is plated from the higher valent state (Cr^{+6}) and needs an activator (catalyst) such as H_2SO_4, Na_2SiO_3, or Na_2SO_4, before the reaction proceeds. Several theories have been advanced, concerning the chemistry of chromium plating and its low efficiency. One theory states that a complex is formed, in the nature of $Cr(OH)CrO_4$, on the base metal which inhibits plating. As the metal content of the bath diminishes, the *p*H rises, and the complex is slowly reduced to chromium metal. Another theory, by Eckwahl, involves a complex of SO_4^{-2} with Cr^{+3}, and a third theory of polyvalent changes—$Cr^{+6} = Cr^{+3}$ (or Cr^{+2}) $= Cr^0$—states that the low efficiency is due to the inability of the low-valence ions to plate, and that the SO_4^{-2} acts as an precipitating agent for the colloids in the solution which then adhere to the ions, resulting in no plating because of poor conductivity. It also is possible that the chromium may precipitate on the cathode as CrH_3 (chromium hydride), and then become reduced to chromium and hydrogen gas.

BRIGHTENERS, BUFFERS AND pH CONTROL

Brighteners are used to decrease the grain size of the metal crystals, decrease the tendency to "tree," and to increase the current density range. They are generally organic additives, although there are some exceptions. There have been occasions when such things as evaporated milk and Instant Postum have been added to obtain a bright finish from certain baths. The following are some of the addition agents that may be used in various plating baths:

Acid copper	glue, dextrose, phenolsulfonic acid
Iron chloride	manganese chloride
Lead fluoroborate	gelatin, glue
Silver cyanide	ammonium thiosulfate, carbon disulfide
Acid tin	glue, cresol, resorcinol, cresylic acid, B-naphthol
Tin-lead fluoroborate	glue, resorcinol
Nickel-cobalt	formaldehyde, sodium formate
Acid lead	glue, gelatin
Acid zinc	licorice

Nickel brighteners are usually added in the amount of 1–2 per cent of the solution by volume, and can be bought as proprietary additives with a balanced ratio to obtain the brightest finish. These generally fall in the group of aryl polysulfonates, or amides and amines. Secondary brighteners are organics usually of the C = O or C = C bond types.

Buffers are used to control the *p*H level, as a protection against the introduction of materials that would contaminate the bath, causing a difference in the *p*H and destroying the action of the bath. One common buffer in nickel solutions is boric acid. It hydrolyzes very slowly in the following manner:

$$H_3BO_3 \rightleftharpoons H_2BO_2^{-1} + H^{+1}$$
$$H_2BO_3^{-1} \rightleftharpoons HBO_3^{-2} + H^{+1}$$
$$HBO_3^{-2} \rightleftharpoons BO_3^{-3} + H^{+1}$$

This three-stage ionization will neutralize (or absorb) large quantities of ions, either acidic or basic, before it loses its efficiency. Buffers do not actively enter into the chemical composition of the bath, but act primarily to stabilize the *p*H in many plating baths.

This concluded the first session of the Industrial Electrochemistry course. At the last meeting of the session, a questionnaire was issued to the students. When these were returned, two answers were prominent—(1) The course was enjoyed and found to be very informative, and (2) some of the material explained by chemical formulas was considered to be somewhat involved and difficult to understand. Consequently, steps were taken to simplify the explanations to the students.

ALLOY PLATING

The second session opened with the discussion of alloy plating. The most popular alloy bath used in this area is brass plating. The cyanide bath is used because of its com-

plexing features, and because an acid solution would only favor deposition of the copper. A second metal (e.g., tin, zinc or cadmium) in the bath improves the cathode efficiency, and changes the physical properties of the metal by co-positing in the metallic lattice of the plate, thus alloying with the copper. The copper acts as a "noble" metal in the bath, although this can be changed by increasing the current density. Sometimes, ammonium hydroxide is added to give a more uniform color over a wider range of concentrations.

Tin plating, not widely used in this area, was covered briefly. The sodium stannate bath make-up was explained and it was shown how hydrogen peroxide was used to convert Sn^{+2} to the Sn^{+4} state, when an excess of stannite ions were present. Also explained was how sodium hydroxide prevents hydrolysis of the stannate ions and improves the anode corrosion. Sodium oleate is often used to act as an anti-foaming agent.

NICKEL PLATING

The bright and semi-bright nickel baths were discussed. Some addition agents prevent pitting but care must be used not to exceed the recommended concentration or the ductility may be affected as well as hardness and residual stress. The *p*H control is very important in this bath. Low *p*H in some baths, in the range of *p*H 1–2, can cause a dull finish, due to the large granular structure of the deposit. A *p*H of 3.5–5.0 was said to be the best range for a bright plate. A higher *p*H also will increase the throwing power of the bath, and small additions of cobalt tend to increase the corrosion resistance of the plate.

Electroless nickel plating received some study during this course. The particular bath discussed consisted of nickel chloride, disodium phosphate, ammonium citrate, and ammonium chloride. This bath (as well as most of the other types) is used at its boiling point for maximum rate of deposition.

PRECIOUS METAL PLATING

In the precious metal plating field, gold and silver baths were considered the most important in this area, the most popular gold solution utilizing a complex salt—potassium gold cyanide ($KAu(CN)_2$). Dipotassium phosphate is used in this bath to aid conductivity and give a smoother plate. This bath is normally used for plating a deposit of 0.00001 to 0.0001 inch thick, and can be used in both rack plating and barrel plating. Stainless steel is commonly used for the anodes, and the usual range of current density is from 1–10 amp/sq ft.

Silver is used locally for both decorative and electronic types of plating. A strike is employed before plating which consists of a high cyanide/low silver composition to give a tenacious undercoating of the plate to the base metal. In the case of ferrous materials, either a copper flash or two silver strikes are used, after the surface is activated in an acid pickle bath. Brighteners, now commercially available, can give a bright and somewhat hard finish to the metal. Since silver has the tendency to develop a yellowish haze due to the small amounts of sulfur compounds in the air, decorative silver is often coated with a clear, protective chromate type of film.

ALUMINUM ANODIZING

Unfortunately, only enough time remained in this session to study aluminum anodizing. The two specific types of baths discussed involved the chromic acid bath and the sulfuric acid bath. The chromic acid bath is generally used for exterior finishes on aluminum, presumably due to the inclusion of the chromium ions in the lattice of the oxide film. Oxide coatings produced in this bath also have excellent stress qualities and a high resistance to the standard salt spray tests. However, for dyed coatings, the sulfuric acid bath is used most often because it imparts a thicker oxide film to retain the dye particles—especially when using the light pastel colors.

Sulfuric acid baths can be used in various concentrations and at various temperatures to give a range of coatings from a very hard and dense coating to a very soft and porous film. Often a five per cent addition of oxalic acid increases the maximum operating temperature up to 95F, alleviating the cooling problem. Adequate ventilation is required to carry off the fine mist of acid spray. In sealing the anodized coating, a boiling water bath is used, operated at a *p*H of 5.8 to 6.2. When the part is dyed, a "fixing" bath of 0.5 per cent nickel acetate and 0.5 per cent boric acid is employed at 200F for 15 minutes to prevent the sealing water from leaching any color. A solution of 20 g/l of CrO_3 and 27 ml/l of H_3PO_4 will strip this oxide film and can also be used to measure the thickness of the coating because it will not attack the aluminum.

CONCLUSION

Although many points of electroplating were not discussed during this school term this was felt to be a successful beginning for the local platers. The course is supplemented by guest speakers once a month at the AES Branch meetings, and further information about specific problems is acquired from them. After evaluating the material presented in class new courses will be formulated for the future, pertaining to additional study into the plating field and also cover areas not locally involved.

As a result of this course and the study of the material in the various published books, the students obtained a more thorough knowledge of the plating industry.

NOTE: A future article is planned to discuss instruction on such practical subjects as racks, trouble shooting, bath analysis, plating controls, thickness measurement, equipment and design of plating areas.

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THE ROLE OF YELLOW PRUSSIATE IN GOLD PLATING SOLUTIONS

by ANTON F. MOHRNHEIM*

Chemical reactions occurring during the preparation of the yellow prussiate gold bath are suggested. The formation and some properties of the gold salt, $Au_4[Fe(CN)_6]_3$, are described. A new name for this electrolyte is recommended.

INTRODUCTION

FOR THE ELECTROLYTIC deposition of gold, four main types of gold baths are used:[1]

a) Cyanide gold baths,
b) Acid gold baths,
c) Special gold baths,
d) Yellow prussiate baths.

The cyanide gold baths have been the most common. The gold is present as the gold (I)-cyanide (aurous cyanide) complex, $[Au(CN)_2]^-$ and is deposited from its I valence state in accordance with the theoretical electrochemical equivalent of 7.35 grams per ampere-hour. Because of the presence of free cyanide these baths are highly poisonous.

In acid gold baths, when gold is present as the gold (III)-chloride (auric chloride) complex, $[AuCl_4]^-$, the deposition takes place from the III valence state in accordance with the theoretical electrochemical equivalent of 2.45 grams per ampere-hour.

The special gold baths are mostly of proprietary nature. Gold thio-cyanide, gold iodide, and organo-gold complexes have been suggested.

The yellow prussiate gold baths are prepared by boiling gold chloride solutions with either sodium or potassium iron (II)-cyanide (ferrocyanide or yellow prussiate). Besides the advantage of having no free cyanide and the disadvantage that the deposition takes place from the tri-valent state, little is known of the manner in which the bath ingredients function.[2]

According to Mellor, H. Rose[3] stated in 1851 that ferrocyanide ion gives an emerald green coloration with solutions of gold chloride. E. Jordis[4] gave the equation:

$$4AuCl_3 + 3K_4Fe(CN)_6 = Au_4[Fe(CN)_6]_3 + 12\,KCl$$

E. Beutel[5] questioned the equation and was unable to get the reaction product. A gold salt of this formula had not been described in recent pertinent literature.[6,7] A different equation for this reaction will be suggested later by the writer.

According to Beutel, the nature of the reaction between gold (III)-chloride and potassium iron (II)-cyanide is dependent upon relative proportions of reactants. The colors produced—yellow, brown, blue or green—are clear at first and become turbid on exposure to light; if the mixture is boiled or is allowed to stand long enough, a precipitate forms.

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His observations on mixing different volumes of approximately equimolar solutions of reactants are condensed in Table I.

These "colorful" observations are complex and intriguing at first sight. Some explanation of the chemistry of these reactions will be given after the following description of experiments performed by the writer.

EXPERIMENTS

It was found that gold (III)-chloride solutions, when less than one third equimolar potassium iron (II)-cyanide was added and boiled gave a canary yellow precipitate (eq. 1) which was insoluble in water and even in concentrated acids. This yellow precipitate turned black (probably an oxide) when potassium hydroxide was added (eq. 2). It dissolved

---

$$12\,[AuCl_4]^- + 3\,[Fe(CN)_6]^{4-} \rightarrow \underset{\text{yel. ppt.}}{Au_4\,[Fe(CN)_6]_3} + 8\,[AuCl_4]^- + 16\,Cl^- \qquad \text{eq. 1}$$

$$\underset{\text{yel. ppt.}}{Au_4\,[Fe(CN)_6]_3} + 12\,(OH)^- \rightarrow \underset{\text{blk. ppt.}}{2\,Au_2O_3} + \underset{\text{yel. soln.}}{3\,[Fe(CN)_6]^{4-}} + 6H_2O \qquad \text{eq. 2}$$

$$\underset{\text{yel. ppt.}}{Au_4\,[Fe(CN)_6]_3} + 16\,(CN)^- \rightarrow 4\,[Au(CN)_4]^- + \underset{\text{yel. soln.}}{3\,[Fe(CN)_6]^{4-}} \qquad \text{eq. 3}$$

$$[Au(CN)_4]^- + 3e^- \rightarrow Au + 4\,(CN)^- \qquad \text{eq. 4}$$

$$3\,[Fe(CN)_6]^{4-} + 4Fe^{+++} \rightarrow \underset{\text{PRUSSIAN BLUE ppt.}}{Fe_4\,[Fe(CN)_6]_3} \qquad \text{eq. 5}$$

$$6\,[AuCl_4]^- + 3\,[Fe(CN)_6]^{4-} \rightarrow 6\,[Au(CN)_2Cl_2]^- + \underset{\text{lt. gray ppt.}}{Fe_2\,[Fe(CN)_6]} + 12\,Cl^- \qquad \text{eq. 6}$$

(The formula of the complex anion, $[Au(CN)_2Cl_2]^-$, has been accepted from suggestions by previous writers.[7])

$$6\,[AuCl_4]^- + 5\,[Fe(CN)_6]^{4-} + 4H^+ + O_2 \rightarrow 3\,[Au(CN)_4]^- + 3\,[Au(CN)_2Cl_2]^- + \underset{\text{BERLIN GREEN ppt.}}{2Fe\,(III)\,[Fe(CN)_6]} + \underset{\text{green soln.}}{Fe^{++} + 18\,Cl^- + 2H_2O} \qquad \text{eq. 7}$$

$$\underset{\text{BERLIN GREEN}}{2\,Fe\,(III)\,[Fe(CN)_6]} + Fe^{++} + 2H^+ + \tfrac{1}{2}\,O_2 \rightarrow \underset{\text{TURNBULLS BLUE ppt.}}{Fe_3\,[Fe(CN)_6]_2} + H_2O \qquad \text{eq. 8}$$

$$\underset{\text{TURNBULLS BLUE}}{3Fe_3\,[Fe(CN)_6]_2} + 8H^+ + 2O_2 \rightarrow \underset{\text{PRUSSIAN BLUE ppt.}}{2Fe_4\,[Fe(CN)_6]_3} + Fe^{++} + 4H_2O \qquad \text{eq. 9}$$

$$6\,[AuCl_4]^- + 7\,[Fe(CN)_6]^{4-} + 4H^+ + O_2 \rightarrow 6\,Au\,[(CN)_4]^- + \underset{\text{PRUSSIAN BLUE ppt.}}{Fe_4\,[Fe(CN)_6]_3} + 24Cl^- + 2H_2O \qquad \text{eq. 10}$$

$$\underset{\text{PRUSSIAN BLUE}}{Fe_4\,[Fe(CN)_6]_3} + 12KOH \rightarrow \underset{\text{yel. soln.}}{3K_4\,Fe(CN)_6} + \underset{\text{brn. ppt.}}{4Fe(OH)_3} \qquad \text{eq. 11}$$

TABLE I

SCHEMATIC COMPILATION OF REACTIONS OF GOLD AND YELLOW PRUSSIATE AS OBSERVED BY E. BEUTEL[5]

Volume Ratio Gold chloride / Yellow prussiate	Observation
3–25 / 1	Aurous cyanide solution (mainly), yellow.
1 / 1	Gradual change of color from light green to dark brown and on exposure to light, change to emerald green, dark blue and finally blue precipitate.
1 / 2	Emerald green solution precipitates blue ferrocyanide, leaving a yellow liquid with an excess of ferrocyanide.
1 / 10–20	Green solution with brown iron hydroxide precipitate.

in potassium cyanide (eq. 3); from this solution metallic gold was electrolytically deposited at the cathode (eq. 4); this solution also reacted with iron (III)-chloride, forming a blue precipitate (eq. 5). When gold (III)-chloride solution was boiled and a one half equimolar amount of potassium iron (II)-cyanide was added, a light gray precipitate resulted (eq. 6).

When gold (III)-chloride solution was boiled and more than ½ but less than 1 equimolar amount of potassium iron (II)-cyanide was added, a green precipitate formed (eq. 7), which turned blue (eq. 8) and upon standing became darker (eq. 9). Since gold (III)-cyanide is almost colorless, the characteristic color of the iron (II)-ions in the filtrate becomes predominant, that is, light green to emerald, depending upon its concentration.

When gold (III)-chloride solution was boiled and more than 1 equimolar iron (II)-cyanide was added, a blue precipitate formed rather rapidly (eq. 10) and left an almost colorless solution.

Equation 10 describes the conversion of the gold (III)-chloride complex into the gold (III)-cyanide complex which is believed to be the form in which the gold is present in the yellow prussiate gold solution for electroplating.

When potassium hydroxide is added, the blue precipitate is decomposed and brown iron (III)-hydroxide is precipitated and potassium iron (II)-cyanide is formed in solution (eq. 11).

An experimental yellow prussiate gold solution was prepared, using stoichiometric proportions of reactants. The filtrate was pale yellow and did not react with iron (III)-chloride. A 5 millimolar solution of gold (III)-cyanide (approximately 1 g Au/l) with the addition of buffer and conductivity salts was used as a plating bath and gave excellent gold deposits which were fine grained and had a pleasant eye appeal. Articles gold plated in this solution showed obviously better corrosion resistance than articles plated in a conventional gold (I)-cyanide gold bath when exposed to hydrogen sulfide atmosphere. The influence of the plating conditions on the chemical behavior of the platings and their physical properties will be further investigated and data will be published.

CONCLUSIONS

It may be concluded from the results that the existence of the yellow gold salt, $Au_4[Fe(CN)_6]_3$, previously not explicitly described in literature, has been ascertained. The determination of other physical and chemical properties of this highly insoluble, new gold salt is in progress. The results being of no direct interest to electroplaters will be published in an appropriate journal.

The reactions taking place during the preparation of the yellow prussiate gold bath seem to proceed in stages for which the following sequence is suggested:

1. The iron (II)-cyanide complex is less stable than the gold (III)-cyanide complex: consequently the latter is formed.
2. Iron (II)-ions are generally unstable and oxidize slowly to iron (III)-ions. The oxidation is accelerated by boiling the solution.
3. Depending upon the *p*H, either one of the two following reactions will take place:
   a) If the *p*H is <6 and an excess of potassium iron (II)-cyanide is present, the newly formed iron (III)-ions will react to give prussian blue (eq. 5);
   b) If the hydroxyl-ion concentration is large enough, *p*H > 6, the newly formed iron (III)-ions form brown iron (III)-hydroxide precipitate.

The conversion of the prussian blue into $Fe(OH)_3$ (eq. 11) occurs at *p*H >6 as can be shown by calculations from solubility data.[8]

Summing up the equations for the preparation of yellow prussiate gold baths, at *p*H > 6 one can take advantage of the iron (II)-cyanide anion complex gained by destroying the prussian blue precipitate (eq. 11) and the reactions expressed in equations 10 and 11 can be combined and simplified as follows.

$$6\,[AuCl_4]^- + 4\,[Fe(CN)_6]^{4-} + 12\,(OH)^- + 4H^+ + O_2 \rightarrow 6\,[Au(CN)_4]^- + \underline{4Fe(OH)_3} + 24Cl^- + 2H_2O$$

eq. 12*

As shown, for each mole of gold only ⅔ mole of iron (II)-cyanide anions react (eq. 12). Additional yellow prussiate will turn the solution yellow. Any excess of hydroxyl ions will make the solution basic; however, because of the very stable gold (III)-cyanide complex formed, no gold hydroxide will be precipitated. It may be worthwhile mentioning that in previously patented formulations[9] for the preparation of yellow prussiate gold baths much greater amounts than ⅔ mole of potassium iron (II)-cyanide are used. This is justifiable when soluble anodes are used in the bath and high current densities are employed.

*Since this chemical reaction proceeds quantitatively, the amount of reactants is given by their molecular weight times the factor shown and can be employed directly to prepare the gold plating solution.

It appears that in the yellow prussiate gold bath the gold is mainly present as gold (III)-cyanide complex anion from which it is reduced to metallic gold by electromotive force, going probably through transition stages of reduction which thus far have not been identified. The function of the potassium iron (II)-cyanide which is used to prepare the gold plating bath, is primarily to supply the cyanide group to form the gold (III)-cyanide complex. In addition, potassium iron (II)-cyanide disposes of the iron (II)-ions which are intermediately set free during the preparation of the bath by forming different insoluble precipitates; the composition and colors of the precipitate depend upon the amount of reactants, the valence of the iron, and the prevailing *p*H, as suggested in the equations above. The precipitates are removed by filtering and thus do not influence the plating. An excess of potassium iron (II)-cyanide may be present in the bath but is not required for the electrodeposition of gold, particularly when insoluble anodes are used, as is generally the case in this type of gold plating.

It should be pointed out that initially the yellow prussiate gold bath does not contain any free cyanide, but if insoluble anodes are used, it will liberate cyanide during the plating process corresponding to the amount of electrodeposited gold. For each mole of electrodeposited metallic gold, 4 moles of cyanide will be set free (eq. 4). Since the gold content of most of these plating solutions is rather low, for example 5 mM (1 g Au/l), the amount of the created free cyanide, even when the gold in the bath has been completely depleted, is rather low (0.5 g CN/l) in comparison with conventional cyanide baths (approximately 3–15 g CN/l). This statement is in contradiction with the generally accepted concept that yellow prussiate baths contain no free cyanide. Since free cyanide is known to decompose during plating processes the free cyanide content in the bath may be considered to be negligibly small.

REMARKS AND SUGGESTIONS

The historical name "Yellow prussiate gold bath" in the light of the findings above seems to be a misnomer. Although the gold solution may contain yellow prussiate salt in excess, the latter has only an indirect influence on the deposition of metallic gold at the cathode. This does not mean that it has no influence on the physical and chemical properties of the gold plating; on the contrary, there is good reason to believe that it remarkably affects the quality and appearance of the deposited plating. However, in accordance with other types of gold baths mentioned in the classification above, the name "Gold (III)-cyanide gold bath" would appear more definitive and is therefore recommended.

ACKNOWLEDGMENTS

The writer is indebted to Dean T. Stephen Crawford for his encouragement to research in this field, to Mr. Fred W. Bopp, president, Automatic Chain Co., Providence, R. I., for supplying the gold, to his assistants Messrs. William J. Curren, Carl H. Layer and Richard Durst for help in writing and Dr. William E. Ohnesorge, assistant professor of chemistry, for reading and correcting the paper.

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After World War II he emigrated to Canada, where he was appointed in 1952, Research Fellow and Assistant Project Director of the American Electroplaters' Society, Project No. 14, (The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on the Electroplating) at the Ontario Research Foundation in Toronto, Ontario. After his admission to the United States in 1954, he was three years with Leach & Garner Co., in Attleboro, Massachusetts, where he built up and headed their Metallurgical Laboratory. In 1957 he joined the University and in 1959 he became a naturalized American citizen.

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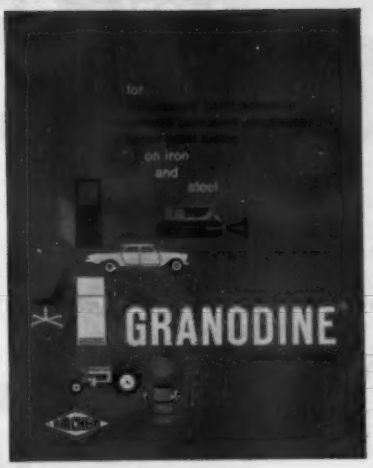

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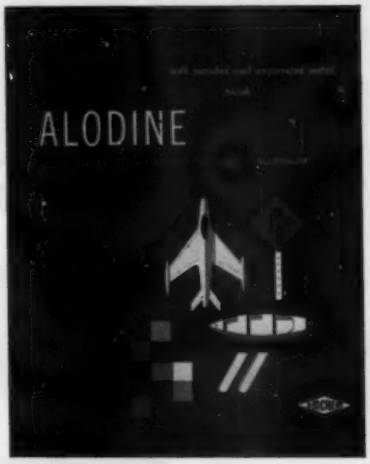

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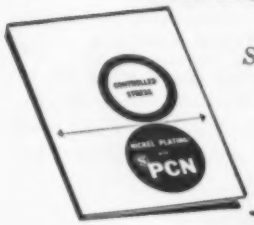

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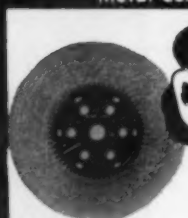
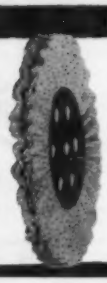


Schaffner manufacturing company, inc.

SCHAFFNER CENTER
EMSWORTH, PITTSBURGH 2, PA.
POplar 1-9902

Metal Center Abrasive Buff



Schaffner manufacturing company, inc.

SCHAFFNER CENTER
EMSWORTH, PITTSBURGH 2, PA.
POplar 1-9902

PATENT ABSTRACTS

DR. D. GARDNER FOULKE
SEL-REX CORPORATION
Nutley, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

2,908,592, 10/13/59—SELENIUM RECTIFIER—H. Storsche, assignor to International Standard Electric Corp., New York, New York.

In the preparation of a selenium rectifier apply a layer of hexagonally crystallizing cadmium selenide before applying the counter electrode. The Cd-Se layer is done by evaporation in a vacuum.

1 Claim.

2,908,619, 10/13/59—PRODUCTION OF TITANIUM—C. Barnett, assignor to New Jersey Zinc Co., New York, New York.

A method of depositing titanium from a fused salt bath using a perforate cathode.

4 Claims, figure.

2,909,455, 10/20/59—ALUMINUM COATING—N. Newhard and D. Dollman, assignors to Amchem Products, Inc., Ambler, Pa.

Treatment of an aluminum phosphating bath by an ion exchange resin is described.

3 claims.

2,909,472, 10/20/59—PRODUCING TITANIUM CRYSTALS—R. Dean, assignor to Chicago Development Corp., Riverdale, Maryland.

The production of titanium crystals from a molten salt bath is described. See 2,909,473 for the production of titanium group metals with 2 claims.

3 claims.

2,909,474, 10/20/59—ELECTROCLEANING APPARATUS—R. Smith, assignor to Jones & Laughlin Steel Corp., Pittsburg, Pa.

An apparatus for cleaning metal strip having electrodes which are a plurality of elongated slat—like members, each positioned transversely of the strip path of travel.

6 claims, figure.

2,909,833, 10/27/59—SOLDERING PRINTED CIRCUITS—W. Murray and J. Dyer, assignors to The Indium Corp. of America, Utica, N. Y.

The method involves plating conductors with a lead-tin alloy, then applying indium and causing it to diffuse into the tin-lead, followed by soldering.

1 claim, figure.

2,909,872, 10/27/59—CLEANING MACHINE—T. Kearney and E. McNamara, assignors to Detrex Chemical Industries Detroit, Michigan.

A drum-like cleaning machine expelling the work from the upper end is described.

10 claims, figure.

2,910,413, 10/27/59—BRIGHTENERS FOR ELECTROPLATING BATHS—W. Strauss and H. Wedell, assignors to Dehydag, Dusseldorf, Germany.

For copper, zinc, silver, nickel, cadmium, bronze and brass baths add 0.01 to 20 g/l of an acylic organic compound of the formula:

$$Q—X—\overset{\overset{Y}{\|}}{C}—Z—R—\overset{\overset{Y}{\|}}{C}—X'—Q'$$

where R = lower aliphatic radical; Q & Q′ = H, alkyl and hydrogy alkyl radicals X, Y & Z = O, S, N and imino group = X′, Y′, Z′

2,910,422, 10/27/59—CONTINUOUSLY ELECTROPLATING STRIP—K. Egge, assignor to U.S. Steel Corp., New Jersey.

In apparatus for continuously electroplating strip, means for supporting said strip for movement in a vertical path, a series of elongated vertically disposed anode bars supported for movement transversely of the strip, said series of anode bars being mounted adjacent the strip and extending across the width thereof, each of said anode bars have a projection at one vertical edge and a recess at the other vertical edge, the vertical projection of one anode bar being received in the vertical recess of the adjacent anode bar.

4 claims, figure.

2,911,332, 11/3/59—COATING METAL—L. Shuster and A. Baldi, assignors to Kelsey-Hayes Co.

A method of providing a chromate conversion coating on nonferrous metals consists of treating the part in an aqueous chromic acid solution and a reducing agent compatible with the chromic acid for at least one day at 80F. The coated surface is finally heated at 250–500F.

23 claims, figure.

2,911,341, 11/3/59—ELECTRODEPOSITION OF AN ALUMINUM COATING—R. Linden, assignor to Mayor Engineering Corp., Chicago, Ill.

To plate an aluminum containing coating onto a metallic surface, pass an unidirectional current through an aqueous solution containing 15 g/l of aluminum sulfate and at least one salt selected from alkali metal, alkaline earth and ammonium sulfate at a *p*H of 3.5–4.5 using a pure aluminum anode.

9 claims.

(*Continued on page 856*)

A fast inexpensive way to clean your plating racks
SIMPLE, AIR OPERATED TOOL
Adjustable . prevents rack injury
INGERSOLL RAND
Does not hammer until anvil touches the metal
.. then strips the metal in seconds.
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PER POUND OF ANODE

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WEIGHT: 1 lb., 3 oz. per inch
LENGTHS: From 3" to 103"

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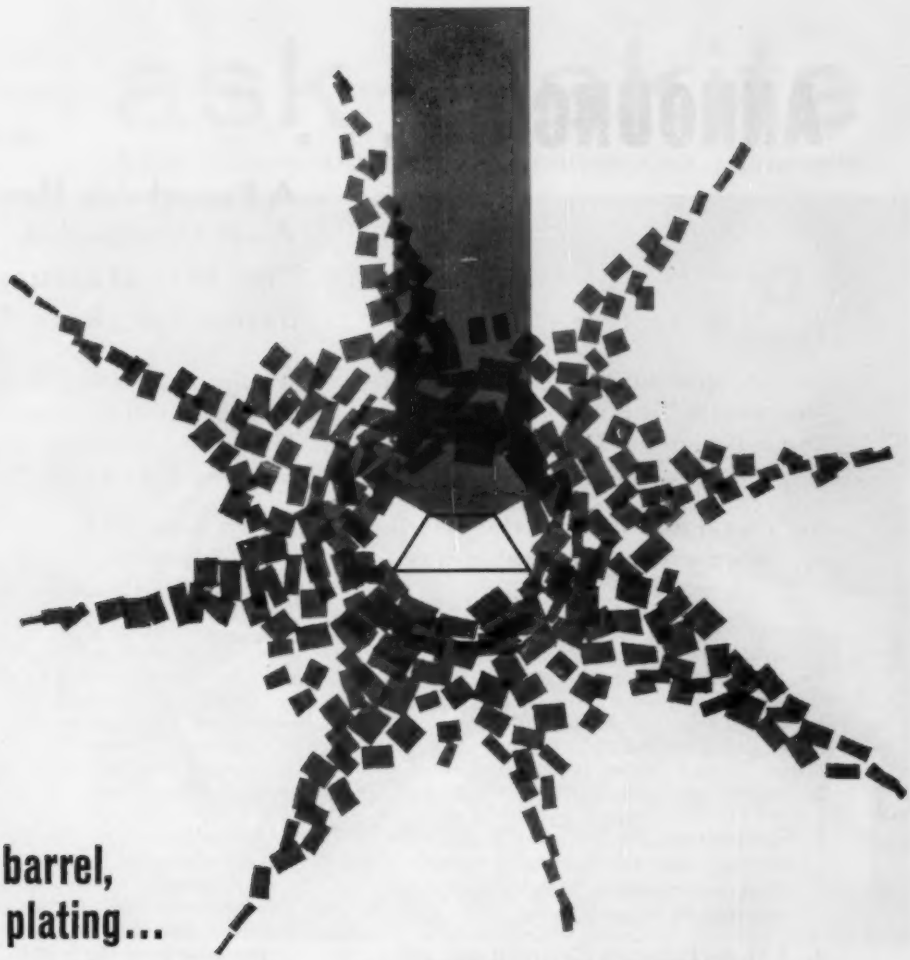

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one-step bright zinc process

Versatile Zincalume handles *all* methods of plating . . . all types of work . . . and plates bright *right out of the bath.* While it readily accepts conversion coatings, Zincalume eliminates the *need* for a bright dip in many applications.

Zincalume is economical, too . . . saves you money because it saves you a step no matter what plating method you use. For detailed information, write to:

Hanson-Van Winkle-Munning Company, Matawan, New Jersey.
Offices in Principal Cities.

Alert Supply Company is H-VW-M in the West.
Los Angeles • San Francisco

P.S. We are *not* out of the bright dip business. Fact is, we're proud of the one we make. A bright dip will improve brightness and shelf life of any zinc finish, but Zincalume looks fine right out of the tank or barrel.

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Progress in metalfinishing through advanced processes • equipment

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 728.

ANNOUNCING . . .

A Remarkable New Marketing And Distribution Plan From The Manufacturer of Baird Barrel Finishing Equipment

In recognition of all the factors influencing or controlling the sale of barrel finishing equipment in the United States today, The Barrel Finishing Equipment Division of The Baird Machine Company proposes a new approach to the market designed around 2 basic aims:

1. **To aid and protect the distributor in every conceivable way.**
2. **To assure the Barrel Finishing Equipment Division of energetic representation in the field.**

Following an intensive study of the market for barrel finishing equipment, the Barrel Finishing Equipment Division has undertaken to completely overhaul and reorganize its sales and distribution system. The continental United States has been divided into 22 territories, each territory containing approximately an equal number of actual and potential barrel users. In each territory will be appointed a single, strategically located distributor who shall be designated as Selected Distributor. To the distributor who qualifies as Selected Distributor the following arrangements will be offered:

1. Complete exclusivity in the designated territory from the moment of appointment encompassing both current volume and all future volume.
2. A Model Poliaction Electratilt unit will be offered, at no cost, on a consignment basis for display or actual demonstration.
3. A Technical Training Course in barrel finishing will be given to all designated Selected Distributor sales representatives at no cost other than transportation.
4. All sales made in the territory will be sold through the Selected Distributor at a "long" discount from list.
5. Any additional distributors in the territory appointed by the Barrel Finishing Equipment Division or the Selected Distributor shall be designated Franchised Distributors and be required to purchase from the Selected Distributor at a "short" discount. Baird will not accept orders direct from Franchised Distributors.
6. A special direct mail program aimed at potential users of barrel finishing equipment in the Selected Distributor's territory shall be executed immediately following appointment in order to develop interest and inquiries. Sales leads resulting from Baird's regular national advertising, publicity and direct mail programs, in addition, shall be forwarded only to the Selected Distributor.

Those distributors who are currently engaged in the active solicitation of business in the metal finishing equipment and supply field are invited to investigate the opportunities afforded them by this plan. The interview of qualified distributors will begin immediately.

If you are interested, write immediately to the attention of "New Marketing Plan," Baird Machine Company, 1700 Stratford Ave., Stratford, Conn.

If you are planning to attend the American Electroplaters Society Convention in Los Angeles, July 24-29, contact Mr. Bennett, Hotel Statler.

Since only 22 Selected Distributors are currently planned, distributors who are interested are urged to respond as promptly as possible. New England, along with the states of New York, New Jersey and Pennsylvania are not considered available territories.

Barrel Finishing Equipment Division

The BAIRD MACHINE COMPANY

1700 Stratford Avenue

Stratford, Conn.

To avoid copper and brass cleaning problems

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

Electroclean copper and its alloys with speed—without tarnish

Oakite 191 gives fast, thorough action in electrocleaning brass and other copper alloys . . . simultaneously protecting against tarnish especially in reverse current tanks. Speeds removal of shop soils, smuts, light buffing compounds . . . provides an effective, non-tarnishing pre-soak for heavily contaminated parts.

But that's not all! It tolerates chromic acid drag-in . . . has high conductivity for efficient use of power . . . works well in hard water . . . rinses freely . . . has long life . . . no objectionable odor . . . won't form precipitate or water-break marks on the work.

Oakite 191 is one of a complete line of materials for cleaning any metal—even the problem ones. Ask the Oakite man. Or send for Bulletin F-9355. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

SCIENCE

over 50 *Est. 1909* *years' leadership in industrial cleaning*

For 62 years...L'HOMMEDIEU...

year after year has manufactured Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing

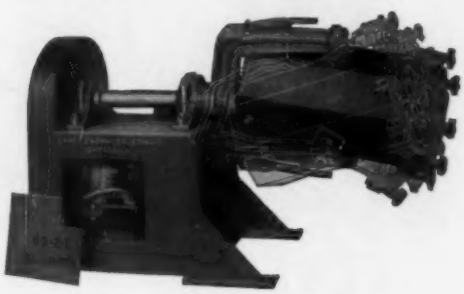
No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 15 H.P. motors. Adopted by leading manufacturers as standard equipment.

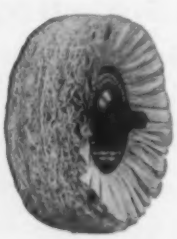
TYPE L — DOUBLE ACTION BARREL For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

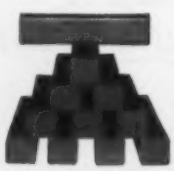
Longer pieces finished more uniformly and without bending.



DURABILITY
PRODUCTION
ECONOMY
EFFICIENCY



RELIANCE NUWAY BUFFS FOR FAST CUTTING



RELIANCE EXTRUDED COMPOSITIONS
STANDARD SIZE 2 x 2 x 10"

THEY CUT
THEY CLEAN
THEY COLOR

THE ANSWER TO INCREASED PRODUCTION AT LOWER COSTS

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AES COMES TO AMERICA'S WEST

TWENTY YEARS after its birth, namely in 1929, ebb of our nation's "Fabulous Twenties," American Electroplaters' Society, Inc. (AES) followed Horace Greeley's historic advice and headed West for broader progress. The two-decade way to that forward move was paved thus.

As the National Electro-Platers Association of the United States and Canada (NEPA), the AES was created in 1909 when the United States had 46 States and a population of about 90 million, with less than 200,000 automobiles and 6,000 trucks on its assembly lines. From New York genesis, it branched to Philadelphia where a Branch was originated in 1910. The Society became international with the birth of its Toronto Branch in 1912. NEPA became AES in 1913, still a New York educational non-profit corporation, the transition occurring at its First Annual Convention, a historic event held on June 1, 1913 in New York City, its birthplace. By year-end 1913, AES comprised 13 Branches. Only a year later, by the way, the Society's burgeoning four-year old magazine, QUARTERLY REVIEW, became MONTHLY REVIEW, immediate forerunner of today's PLATING MAGAZINE.

And so in 1929, numbering some 1,500 members and 25 Branches, AES crossed the American continent and founded its Los Angeles Branch, first west of St. Louis. It compounded its West Coast entry with the creation of its San Francisco Branch in 1930. Both lived and prospered. But over two more decades elapsed before they were supplemented by other AES Branches in the broad American area from the Mississippi River to the Pacific Ocean.

Then in America's "Dynamic Fifties", AES dotted that region with active Branches. It penetrated the great State of Texas with a Branch in Dallas-Fort Worth in 1951. Its Jayhawker Branches were founded in Wichita and in Kansas City in 1952. Its Portland, Oregon, Branch was conceived in 1953. It added Texas Branches in Houston and San Antonio in 1954, and entered the State of Washington with its Seattle Branch in that same year. A year later, Seattle enveloped Puget Sound thus becoming the Seattle-Puget Sound Branch of today. And in 1957, in the Canadian West Coast, AES chartered its present British Columbia Branch with headquarters in Vancouver. Finally, in 1959, in AES's GOLDEN JUBILEE YEAR, AES came to Colorado with a promising Branch in Denver, and to Arizona with a Branch in Phoenix.

In 1960, in its fifty-first year, AES has reached another milepost of progress. Composed of 50 Branches in the United States, 5 in Canada, 3 in Australia, and stronger than ever in its long lifetime—internationally reputed and respected for its service over a half-century span in stimulating advancements in electroplating, metal finishing and allied arts—it will conduct its first Annual Convention on the Pacific Coast, naturally with its Far West pioneer Branch, Los Angeles, as host.

The AES family will make the long trek to the "Golden City" not only as a token of esteem for its trailblazing Los Angeles Branch, and to partake of the vaunted educational and relaxational fare of that wonder city, but also to accommodate and honor its other chartered Branches in that broad area from St. Louis to the shores of the Pacific, namely San Francisco, Portland, Seattle-Puget Sound, British Columbia, Dallas-Fort Worth, Houston, Kansas City, Wichita, Denver and Phoenix.

Thus East and West will join in '60 in an historic first step toward the even greater AES transcontinental Branch unity that seems destined in the "Space Age Sixties," facilitated by the miracles in neutralizing distances being engineered by developments in American and Canadian transportation.

AMERICAN ELECTROPLATERS' SOCIETY'S GALAXY OF WESTERN CHARTERED BRANCHES

LOS ANGELES BRANCH

CHARTERED 1929

WESTERN pioneer of American Electroplaters' Society, Inc. (AES), the Los Angeles Branch was created in the largest municipality of the Eldorado State over thirty years ago and is the Society's fifth largest Branch numerically today. It is the Host Branch of the AES's 47th Annual Convention, first ever held west of the Mississippi River. It has a rich history and a proud record of AES service.

SAN FRANCISCO BRANCH

CHARTERED 1930

AN OFFSHOOT of the Los Angeles Branch but grown large and thriving in its own right, this Branch, situated in one of the burgeoning communities of the fast expanding Golden State, is observing its own Thirtieth Anniversary in 1960. With Los Angeles, it was one of the sponsors in the creation of the AES's Australian Branches. In California's even greater industrial boom expected ahead, this Branch's destiny seems bright indeed.

DALLAS-FORT WORTH BRANCH

CHARTERED 1951

FIRST AES Branch in the Lone Star State and one of the fastest growing Branches of the Society, this Branch is making a proud name for itself in technical and scientific education. The two-day "Aerospace Finishing Symposium" held in Forth Worth, December 8-9, 1959 sponsored by it in collaboration with the Society of Aircraft Materials and Process Engineers (SAMPE) was one of the brilliant features of AES's 1959 educational season. Registrants from 25 states attended.

KANSAS CITY BRANCH

CHARTERED 1952

ONE of the two AES Branches in the Sunflower State, this Branch, by its progressive attitude and consequent progress is making its presence increasingly felt in AES's educational circles. A significant forward step was the quality of its meeting in Kansas City in December 1959 which was addressed by AES National President Ralph D. Wysong himself.

WICHITA BRANCH

CHARTERED 1952

THE other of AES's two present Jayhawker Branches, this Branch, located in the largest city in bountiful Kansas, marks its own Eighth Anniversary as an AES chartered affiliate in 1960. Compact and well-established, it has a large opportunity to enrich knowledge in electroplating, metal finishing and allied arts in its area and, therefore, broad horizon for growth and progress.

PORTLAND BRANCH

CHARTERED 1953

ONLY AES Branch in Oregon and created in that Beaver State seven years ago, this Branch is in the process of constructing an ambitious educational program. Relatively small but well-established, among this Branch's projects is a program of self-enlargement so as to bring to the Webfoot State's plating and metal finishing community, even broader means for enhancing knowledge of the arts and sciences of plating, metal finishing and allied arts.

SEATTLE-PUGET SOUND BRANCH

CHARTERED 1954

AES came to Seattle, the Evergreen State's largest city, in 1954 with the genesis there of its Seattle Branch. A year later, the Branch broadened its jurisdiction to include Puget-Sound and thus became today's Seattle-Puget Sound Branch. Though comparatively small momentarily in numerical stature, the Seattle-Puget Sound Branch nevertheless has ample potential and the will to achieve it.

HOUSTON BRANCH

CHARTERED 1954

SECOND of AES's Texas Branches and domiciled in the largest and fastest growing municipality in the swelling Lone Star State, the Houston Branch's vista for progress through performance appears sizable. Devoted to the principles and educational goal of AES as it is, the Houston Branch shows promise of achieving even greater stature, and attaining even greater prominence in the family of AES chartered Branches during our nation's dynamic Nineteen Sixties.

BRITISH COLUMBIA BRANCH

CHARTERED 1957

A YOUNG Branch in terms of AES longevity, and the pioneer AES Branch in the Dominion of Canada's western flank, the British Columbia Branch, domiciled in Vancouver, has a firm foundation and is responsibly managed. A dedicated Branch, it is making steady progress in achieving stature and status through service. It is one of AES's five Canadian Branches. As American distances are further shortened in the Sixties by ever-improving air transportation, its AES role should also grow appreciably.

DENVER BRANCH

CHARTERED 1959

ONE of AES's two youngest Branches, the Denver Branch was installed as a chartered AES affiliate at an impressive installation event held in that largest city of Colorado, our nation's Centennial State, October 13, 1959, with the Attorney General himself giving the State's welcome to AES in behalf of its Governor. Against the background of Denver's great industrial growth, AES forecasts that Denver will become a large and thriving Branch within the foreseeable future.

PHOENIX BRANCH

CHARTERED 1959

THE other of AES's two youngest Branches, the Phoenix Branch was officially chartered at a gala AES installation ceremony held in Scottsdale, Arizona, October 9, 1959, in the presence of the Governor of Arizona and the Mayor of Phoenix. Despite its relative youth, the Branch has not only already grown larger but has also conducted an impressive "Metal Finishing Symposium" in Phoenix, March 26, 1960.

NORRIS POULSON
MAYOR

OFFICE OF THE MAYOR
CITY HALL
LOS ANGELES 12, CALIFORNIA

PROCLAMATION

TO THE CITIZENS OF LOS ANGELES, GREETINGS:

WHEREAS, Los Angeles will be the site this year of the Annual Convention of the American Electroplaters' Society, Inc., and

WHEREAS, the Los Angeles branch of this organization is more than 30 years old, indicating that this city is a leader not only in the electroplating industry but also in its scientific organizations and advancement, and

WHEREAS, electroplating is an industry which treats materials used by everyone in his home and business;

NOW, THEREFORE, as Mayor of the City of Los Angeles, I proclaim the week of July 24-28, 1960, as AMERICAN ELECTROPLATERS' SOCIETY WEEK and I call upon all citizens to familiarize themselves with this important organization and its contributions to better living.

Norris Poulson
MAYOR

EDMUND G. BROWN
GOVERNOR

State of California

GOVERNOR'S OFFICE
SACRAMENTO

GREETINGS TO THE MEMBERS OF THE
AMERICAN ELECTROPLATERS' SOCIETY, INC.

It is a pleasure to extend a warm California welcome to the Forty-seventh Annual Convention of the American Electroplaters' Society.

The Golden State is honored to be host to this important nationwide organization, and its citizens are fortunate to have the opportunity of learning more about the vast scope of its productivity, touching the lives of all of us.

The AES research program, widely recognized for its support of outstanding projects at universities in both the United States and Canada, doubtless will have valuable reports to make of high interest to industry in California and the nation.

To all delegates, their families and friends may I express best wishes for a most successful convention and a pleasant sojourn in Los Angeles.

Sincerely

Edmund G. Brown

EDMUND G. BROWN
Governor of California

WELCOME AES MEMBERS

Tony Stabile

THE Los Angeles Branch sends you greetings from the Golden West. This is the first National Convention of our Society held on the Pacific Coast and great things are in store for all participants.

For our Educational Sessions, we have assembled a group of outstanding speakers who will provide you with up-to-date information on a variety of recent metal finishing developments, including sessions on organic finishing techniques. We have also scheduled a Symposium on Hydrogen Embrittlement featuring recognized authorities in this field. Our plant visits will be most unusual and will offer you opportunities to broaden your experience in the finishing fields.

Our plans include a wide variety of entertainment for the ladies and children while the men are attending the outstanding Educational Sessions being presented. We assure you that this will be the most pleasant and informative Convention you ever attended.

TONY STABILE
General Chairman—1960 Convention

Mrs. Glenwood J. Beckwith

WELCOME AES LADIES

THE Ladies Committee has planned an outstanding program to entertain you on your visit to Los Angeles for the American Electroplaters' Society Convention, July 24–28, 1960. We would love to have you join us. We want to show you how Western hospitality can make this one of the most memorable events you have ever attended. Welcome to Los Angeles and to AES's 47th Annual Convention.

Mrs. Glenwood J. BECKWITH
Chairman, Ladies Program

1960-1961 OFFICERS OF THE LOS ANGELES BRANCH

Board of Managers—Norman K. McEwan, Norman F. Painter, Clare P. Ver West

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Librarian

Harvey K. Hunt
Second Vice President

Frank Virgil
President

Emmett H. Babcock
First Vice President

H. P. Wanamaker
Treasurer

Robert H. Pooler
Secretary

CONVENTION PROGRAM

SUNDAY, JULY 24

9:00 a. m. **Executive Board Meeting (All Day)** — Dallas Room (Hq. Room)
10:30 a. m. **Ladies' Program. Brunch Honoring National Officers Wives—Sponsored by Los Angeles Branch** — Boston Room
2:00 p. m. **Honorary Membership Award Committee Meeting** — Washington Room
2:00 p. m. **Scientific Achievement Award Committee Meeting** — St. Louis Room
3:00 p. m. **Ladies Program. Western Welcome Tea** — Garden Room
4:00 p. m. **Credentials Committee Meeting with Executive Board** — Dallas Room
8:00 p. m. **Get-Together Party** — Golden State Room

MONDAY, JULY 25

8:30 a. m. **Children's Program—Supervised Bus Outing** — Leave from Statler Hotel
Itinerary includes Forest Lawn Park, Griffith Park, Universal-International Movie Studio, Farmers' Market (includes lunch), "Homes of the Stars" in Hollywood and Beverly Hills, Santa Monica Beach
10:00 a. m. **Grand Opening Session** — Golden State Room
11:00 a. m. **Business Meeting, Supreme Society** — Golden State Room
12:00 noon **Branch Secretaries' Luncheon** — New York Room
12:00 noon **Ladies Program. Luncheon and Entertainment** — Pacific Room
12:15 p. m. **Speakers' Luncheon** — Cleveland Room
2:00 p. m. **Educational Opening Session** — Golden State Room
The Second Annual "William Blum Lecture"—"Faraday's Laws Applied to Cleaning" by Dr. A. Kenneth Graham, Graham, Savage & Associates, Inc., Second Winner, AES Scientific Achievement Award
2:00 p. m. **Plant Visit, U.S. Chem Milling Corp., Manhattan Beach** — Bus from Statler Hotel
2:30 p. m. **Editorial Board Meeting** — Boston Room
2:30 p. m. **Midwest Regional Council Meeting** — Dallas Room
2:30 p. m. **Educational Session A** — Golden State Room
"Applying Statistical Quality Control to Plating Processes" by Robert W. Steinmetz, Western Electric Company, Inc.
"Chemical Milling: Controlled Metal Removal With Chemicals" by C. Conner Shepherd, North American Aviation, Inc.
"Hazards in the Plating Room" by Dr. Walter R. Meyer, Enthone, Inc., Subsidiary of American Smelting and Refining Company
2:30 p. m. **Educational Session B** — West Garden Room
"Adhesion of Organic Enamels to Electrodeposited Nickel" by Francis X. Carlin, The International Nickel Company, Inc., Research Laboratory
"Solid Film Lubricants as Organic Finishes" by Lowell C. Horwedel, Electrofilm, Inc.
"Magnesium Corrosion" by E. I. Weed, Convair/Pomona, Convair Division of General Dynamics Corporation
4:00 p. m. **Order of Past Presidents' Business Meeting** — Detroit Room
6:30 p. m. **Order of Past Presidents' Dinner** — Washington Room
8:00 p. m. **Convention Ball (Given by Metal Finishing Suppliers' Association—Admittance by Registration Badge)** — Pacific & Sierra Rooms

TUESDAY, JULY 26

8:00 a. m. **Charles Henry Proctor Memorial Leadership Award Selection Committee Breakfast** — Boston Room
8:00 a. m. **Speakers' Breakfast** — Cleveland Room
8:30 a. m. **Golf Tournament (Sponsored by MFSA)** — Los Coyotes Country Club, Buena Park
9:00 a. m. **Membership Committee Meeting** — Washington Room
9:00 a. m. **Public Relations Committee Meeting** — Detroit Room
9:00 a. m. **Southwestern Regional Council—Organization Meeting** — Dallas Room
9:00 a. m. **Educational Session C** — Golden State Room
"Recent Developments in Gold Electroplating" by Barnet D. Ostrow, Lea-Ronal, Inc.
"A Cyanide Bath for Heavy Gold Plating" by James K. Gore and Robert Seegmiller, University of California, Los Alamos Scientific Laboratory
"Acid Gold Plating" by Robert A. Ehrhardt, Bell Telephone Laboratories, Inc.
9:00 a. m. **Educational Session D** — West Garden Room
"Corrosion and Electrode Potential Studies of Nickel-Chromium Systems" by Arthur H. Du Rose, The Harshaw Chemical Company
"A Progress Report on Experiences in Improving the Corrosion Resistance of Automotive Parts" by J. D. Thomas, D. W. Hardesty and C. F. Nixon, General Motors Corporation Research Laboratories

BEFORE THE SUPREME SOCIETY

AGENDA
FIRST BUSINESS SESSION

GOLDEN STATE ROOM
STATLER HOTEL, LOS ANGELES, CALIFORNIA
MONDAY MORNING, JULY 25, 1960

I Call to Order, ANNUAL MEETING.
II Roll Call of Officers.
III Report of Credentials Committee.
IV Roll Call of Delegates.
V In Memoriam.
VI Reports of Officers (Published Copies in DELEGATES KITS):
- (a) President
- (b) First Vice President
- (c) Second Vice President
- (d) Third Vice President
- (e) Past President
- (f) Executive Secretary

VII Reports of Standing and Special Committees (Copies in DELEGATES KITS).
VIII Report on New Branches.
IX 1959–1960 Financial Statement and 1960–1961 Budget (Copies in DELEGATES KITS).
X Report of Paper Awards Committee and Presentation of Awards.
XI Announcement of Board Appointments To:
- (a) Editorial Board
- (b) Research Committee
- (c) Public Relations Committee
- (d) Election Committee
- (e) Honorary Membership Awards Committee
- (f) Educational Committee
- (g) Membership Committee
- (h) Publications Committee
- (i) Scientific Achievement Award Committee

XII Business Brought for Discussion by Delegates.
XIII Recess of ANNUAL MEETING.

AGENDA
SECOND BUSINESS SESSION

SIERRA ROOM, STATLER HOTEL, LOS ANGELES
THURSDAY, JULY 28, 1960

I Call to Order, ANNUAL MEETING.
II Roll Call of Officers.
III Roll Call of Delegates.
IV Roll Call of Living Past Presidents.
V Financial Statement (1959–1960) and Proposed Operating Budget (1960–1961):
- (a) Action on Financial Statement
- (b) Action on Proposed Operating Budget (1960–1961)
- (c) Report of Executive Board on reinvestment of Reserves

VI Consideration of Any "Sense of Meeting" Resolutions Adopted by the Seventh Interim Meeting.
VII Report on Membership Competition. Presentation of Awards.
VIII Action on Nominees for AES Honorary Membership.
IX Introduction of 1960 "AES Scientific Achievement Award" Winner.
X Business Brought for Discussion by Delegates.
XI Discharge of 1959–1960 Special Committees.
XII Nomination and Election of 1960–1961 Officers:
- (a) President
- (b) First Vice President
- (c) Second Vice President
- (d) Third Vice President

XIII Installation Ceremony:
- (a) Installation of Newly Elected Officers
- (b) Presentation of Gavel to New President
- (c) Presentation of Plaque and Past President's Pin to Retiring President

XIV Report by Los Angeles Convention General Chairman.
XV Reports by Future Convention Chairmen (Boston, Milwaukee, Atlantic City, St. Louis, New York).
XVI Report of Eighth Interim Meeting (1961) Chairman.
XVII Selection of Convention City of AES's Fifty-Third Annual Convention (1966).
XVIII Recommendation of Executive Board as to Place and Date of AES's Sixth Industrial Finishing Exposition.
XIX Selection of Site and Date of Ninth Interim Meeting (1962).
XX Resolution of Thanks to Los Angeles Branch.
XXI Adjournment of ANNUAL MEETING.

EDUCATIONAL SESSIONS CHAIRMEN
AES 47th ANNUAL CONVENTION
LOS ANGELES, CALIFORNIA

OPENING SESSION

Dr. William Blum

SESSION A

Dr. Harold J. Wiesner

SESSION B

Herberth E. Head

SESSION C

Dr. Russel E. Harr

SESSION D

Dr. R. B. Saltonstall

SESSION E

Dr. Harold J. Read

SESSION F

Dr. Samuel Heiman

SESSION G

Dr. Abraham M. Max

SESSION H

Francis T. Eddy

SESSION I

Maurice R. Caldwell

"New Data on the Performance of Nickel and Chromium Plated Zinc Die Castings" by W. H. Safranek, H. R. Miller, R. W. Hardy, and Dr. C. L. Faust, Battelle Memorial Institute

"A Study of Variations in Certain Characteristics of Bright Nickel Deposits with Variations in Bath Temperature" by R. J. Clauss, The Udylite Research Corporation

2:30 p. m. Annual Outing (Buses leave Statler Hotel) ..... **Disneyland**

WEDNESDAY, JULY 27

8:00 a. m. Research Committee Breakfast ..... **Cleveland Room**
8:00 a. m. Speakers' Breakfast ..... **Buffalo Room**
8:30 a. m. Children's Program—Supervised Visit ..... **Bus from Statler Hotel**
Marine Land of the Pacific and Knott's Berry Farm (lunch)
9:00 a. m. Educational Session E—"Hydrogen Embrittlement in Metal Finishing" Symposium ..... **Golden State Room**

"The Metallurgical Aspects of Hydrogen Embrittlement in Metal Finishing" by Dr. Harold J. Read, Department of Metallurgy, The Pennsylvania State University

"On the Mechanism of Transport of Hydrogen Across a Solution-Metal Interface" by Dr. Richard J. Barton, Wright Air Development Division, Wright-Patterson Air Force Base

"The Behavior of Hydrogen in Iron and Steel" by Maynard L. Hill, Westinghouse Electric Corporation Research Laboratories

"Detection and Control of Chemisorbed Hydrogen During Electrolysis" by Samuel C. Lawrence Jr., Metal Physics Laboratory, Boeing Airplane Company

9:00 a. m. Research Committee Meeting ..... **Detroit Room**
9:00 a. m. Publications Committee Meeting ..... **Boston Room**
9:00 a. m. Educational Committee Meeting ..... **Washington Room**
12:00 noon Joint Educational Committee and Branch Librarians' Luncheon ..... **New York Room**
12:00 noon Speakers' Luncheon ..... **Buffalo Room**
12:30 p. m. Ladies' Program. Luncheon and Don Loper Fashion Show (Buses leave Statler Hotel at 11:00 a. m.) ..... **Sportsmen's Lodge, North Hollywood**
2:00 p. m. Research Committee Meeting ..... **Detroit Room**
2:00 p. m. Educational Session F—"Hydrogen Embrittlement in Metal Finishing" Symposium ..... **Golden State Room**

"Measurements Pertaining to Hydrogen Embrittlement" by Cloyd A. Snavely, Battelle Memorial Institute

"A New Look at the Hydrogen Embrittlement of Cadmium Coated High Strength Steels" by Norman M. Geyer, G. William Lawless, and Bennie Cohen, Materials Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base

"Effectiveness of Metallic Undercoats in Minimizing Plating Embrittlement of Ultra High Strength Steel" by Dr. Walter Beck and E. J. Jankowsky, Naval Air Material Center, Aeronautical Materials Laboratory

"Control of Hydrogen Embrittlement by Plating from Cadmium Cyanide Baths Containing Nitrate" by Dr. W. F. Hamilton and Myron Levine, Lockheed Aircraft Corporation, California Division

4:00 p. m. AES Regional Group and Council Chairmen's Meeting ..... **Dallas Room**
7:30 p. m. Round Table Discussion on "Hydrogen Embrittlement in Metal Finishing" ..... **Los Angeles Room**
9:30 p. m. Floor Show and Dance ..... **Pacific & Sierra Rooms**

THURSDAY, JULY 28

8:00 a. m. Speakers' Breakfast ..... **St. Louis Room**
8:30 a. m. Children's Program—Boat Trip or Substitute Attraction ..... **Bus from Statler Hotel**
9:00 a. m. Business Meeting, Supreme Society ..... **Sierra Room**
9:00 a. m. Educational Session G ..... **Golden State Room**

"Magnetic Properties of Electrodeposited Cobalt Alloys" by Dr. Victor Zentner, Hughes Aircraft Company

"Plating of Nickel, Cobalt, Iron and Cadmium from Sulfamate Solutions" by Richard C. Barrett, Barrett Chemical Products Company

"The Chemical Reduction of Nickel-Phosphorus Alloys from Pyrophosphate Solutions" by Morton Schwartz, Kelite Corporation

9:00 a. m. Educational Session H ..... **West Garden Room**

"Solution Transfer in Barrel Plating" by Paul Glab, R. Scott Modjeska and Simon P. Gary, Scientific Control Laboratories, Inc.

"Cleaning Techniques in the Electronics Industry" by Dr. D. E. Koontz, Dr. D. O. Feder and Dr. C. O. Thomas, Bell Telephone Laboratories, Inc.

"Chromium Plating of Rifle Barrels" by Robert J. Girard and Edward F. Koetsch Jr., Springfield Armory

9:30 a. m. Plant Visit, McCulloch Corp., Los Angeles ..... **Bus from Statler Hotel**
10:30 a. m. Ladies' Program. Motion Picture Studio Tour ..... **Bus from Statler Hotel**
12:30 p. m. Ladies' Luncheon (Dutch Treat) and Shopping ..... **Farmer's Market**
1:00 p. m. Plant Visit, Golden Citrus Juices, Inc., Anaheim ..... **Bus from Statler Hotel**
2:00 p. m. Business Meeting, Supreme Society ..... **Sierra Room**
2:00 p. m. Educational Session I ..... **Golden State Room**

"AES Research—Its Purpose and Accomplishments" by J. D. Thomas, 1959–1960 Chairman, AES Research Committee

"Corrosion Protection with Decorative Chromium" by Dr. E. J. Seyb, Metal & Thermit Corporation

"Experience in the Operation and Performance of Dual Chromium Systems" by W. E. Lovell, E. H. Shotwell and James Boyd, Ternstedt Division, General Motors Corporation

6:00 p. m. Cocktail Party (Given by Metal Finishing Suppliers' Association) ..... **Wilshire Room**
7:00 p. m. Annual Banquet and Dance ..... **Pacific & Sierra Rooms**

FRIDAY, JULY 29

8:00 a. m. President's Breakfast to National Officers & Families ..... **AES Executive Suite**
9:00 a. m. Executive Board Meeting ..... **Dallas Room**

The lion of Leon and the Castle of Castile are from the Arms of Spain and represent Los Angeles under Spanish control from 1542 to 1821. The eagle holding a serpent is from the Arms of Mexico and represents the period of Mexican sovereignty from 1822 to 1846. The bear flag typifies the California Republic of 1846.

The Stars and Stripes indicate the present status of Los Angeles as an American City. The sprays of Olive, Grape and Orange suggests the location of Los Angeles as a City set in a garden—the beaded circle surrounding the seal represents a Rosary suggesting the part played by the Mission Padres in founding the City.

AES BOARD AND COMMITTEE MEETINGS AT 47TH ANNUAL CONVENTION

		Room	Presiding
SUNDAY, JULY 24			
9 a.m.	Executive Board	Dallas	Ralph D. Wysong
1 p.m.	Honorary Membership Award Committee	Washington	Leslie L. Diveley
3 p.m.	AES Scientific Achievement Award Committee	St. Louis	Dr. Henry B. Linford
4 p.m.	Credentials Committee	Dallas	Arthur W. Logozzo
MONDAY, JULY 25			
12 p.m.	Branch Secretaries	New York	John P. Nichols
2:30 p.m	Editorial Board	Boston	John P. Nichols
2:30 p.m.	Midwest Regional Council	Dallas	Leslie L. Diveley
4:00 p.m.	Order of Past Presidents	Detroit	Dr. Samuel Heiman
TUESDAY, JULY 26			
8 a.m.	Proctor Award Selection Committee	Boston	Ralph D. Wysong
9 a.m.	Membership Committee	Washington	M. Lester Reynolds
9 a.m.	Public Relations Committee	Detroit	Robert M. Norton
9 a.m	Southwest Regional Council	Dallas	M. E. Browning, Jr.
WEDNESDAY, JULY 27			
8 a.m.	Research Committee Breakfast	Cleveland	James D. Thomas
9 a.m.	Research Committee	Detroit	James D. Thomas
9 a.m	Publications Committee	Boston	Dr. Samuel Heiman
9 a.m.	Educational Committee	Washington	Dr. Dodd S. Carr
12 p.m	Branch Librarians and Educational Committee	New York	Dr. W. A. Wesley
4 p.m.	Regional Council Chairmen	Dallas	John P. Nichols
FRIDAY JULY 29			
9 a.m.	Executive Board	Dallas	Dr. W. A. Wesley

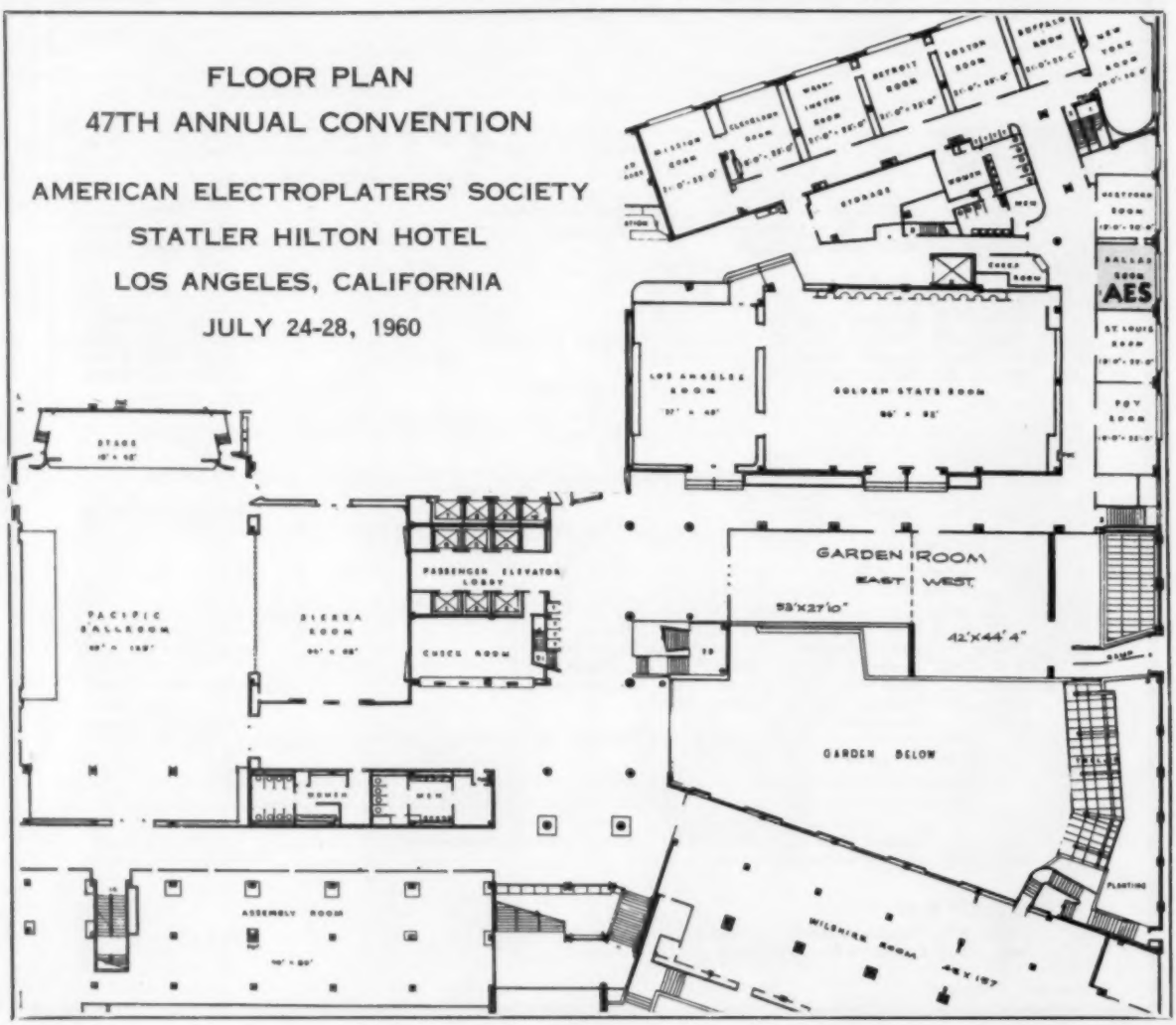
FLOOR PLAN
47TH ANNUAL CONVENTION

AMERICAN ELECTROPLATERS' SOCIETY

STATLER HILTON HOTEL

LOS ANGELES, CALIFORNIA

JULY 24-28, 1960



EDUCATIONAL SESSIONS PROGRAM

47TH ANNUAL CONVENTION, AMERICAN ELECTROPLATERS' SOCIETY, INC.

STATLER HOTEL, LOS ANGELES, CALIFORNIA, JULY 24-28, 1960

MONDAY, JULY 25

OPENING SESSION

2:00 p.m. ..... Golden State Room

Session Chairman—*Dr. William Blum*

THE SECOND ANNUAL "WILLIAM BLUM LECTURE"— FARADAY'S LAWS APPLIED TO CLEANING

by Dr. A. Kenneth Graham, Graham, Savage & Associates, Inc.

2:30 p.m. ..... Golden State Room

SESSION A

Chairman—*Dr. Harold J. Wiesner, Bendix Products Division, Bendix Corporation*

APPLYING STATISTICAL QUALITY CONTROL TO PLATING PROCESSES

by Robert W. Steinmetz, Western Electric Company, Inc.

Statistical quality control is a scientific method of analyzing data and using the analysis to solve practical problems. Its application to the control of plating baths and plating thickness to reduce costs and increase quality is illustrated. Cost reduction and quality improvement can be illustrated best by utilizing the control chart which has the ability to form data into patterns which when tested statistically can lead to information about the process.

CHEMICAL MILLING: CONTROLLED METAL REMOVAL WITH CHEMICALS

by C. Conner Shepherd, North American Aviation, Inc.

The factors which have led to the development of chemical techniques for metal removal are discussed in relation to present applications of the chemical milling process. The factors to be considered in selection of a chemical etchant are described, along with variables influencing efficiency of the major processing steps.

HAZARDS IN THE PLATING ROOM

by Dr. Walter R. Meyer, Enthone, Inc., Subsidiary of American Smelting and Refining Company

Hazards in the plating room including fire, explosion, eruption, uncontrolled reactions and electrical are discussed. Uncontrolled chemical reactions are discussed at length including reactions of oxidizing agents such as hydrogen peroxide, chromic acid, permanganate, perchlorates, persulphates, etc. Accidents involving identity of chemicals, rate of mixing, spontaneous combustion autoignition, metal dust explosions, heats of reaction, caking, electrical shorts and poor housekeeping are described. Hazards of bright dipping and electropolishing solutions are described at length as well as many types of hydrogen explosions. Actual vivid demonstrations of explosions and hazards are presented.

2:30 p.m. ..... West Garden Room

SESSION B

Chairman—*Herberth E. Head, Engineering Division, Chrysler Corporation*

ADHESION OF ORGANIC ENAMELS TO ELECTRODEPOSITED NICKEL

by Francis X. Carlin, The International Nickel Company, Inc., Research Laboratory

Strong bonds between freshly deposited nickel and subsequent organic enamel finishes have been affected. Various aqueous solutions of organic and inorganic compounds are employed as post-treatments for the electrodeposits. The solutions apparently react either to cause a conversion-type film on the nickel surface or to deposit a thin film of material which becomes strongly bonded to nickel. The film produced is receptive to application of a coating of organic enamel. Types of solutions, methods of application of nickel, films, and organic finishes, and the method for testing the bond are discussed.

SOLID FILM LUBRICANTS AS ORGANIC FINISHES

by Lowell C. Horwedel, Electrofilm, Inc.

The place in which solid film lubricants fit into the organic finishing industry is presented. The diversified field of their application as organic finishes, due to such physical properties as color, electrical conductivity, corrosion resistance and others is discussed. Emphasis is placed on corrosion resistance and substantiating data is presented graphically and with photographs. The effect of pre-treatments on the corrosion resistance of base metals "coated" with solid lubricants and the relative corrosion resistance of the base metals so treated is developed at considerable length.

Dr. A. K. Graham

Lowell C. Horwedel

R. W. Steinmetz

Dr. Walter R. Meyer

Francis X. Carlin

E. I. Weed

Barnet D. Ostrow

Fred I. Nobel

James K. Gore

Robert Seegmiller

Robert A. Ehrhardt

MAGNESIUM CORROSION

by E. I. Weed, Convair/Pomona, Convair Division of General Dynamics Corporation

Considerable progress has been made in the past ten years in the field of materials and processes for the corrosion protection of magnesium. These improvements include anodizing processes, plating processes and various organic coating materials. In spite of these improvements, the protection of magnesium when subjected to a corrosive environment continues to be a problem. This problem can be solved in most cases by intelligent use of protective mechanisms now available, attacking on three levels—engineering, production and quality control.

TUESDAY, JULY 26

9:00 a.m. ..... Golden State Room

SESSION C

Chairman—Dr. Russel E. Harr, Western Electric Company, Inc.

RECENT DEVELOPMENTS IN GOLD ELECTROPLATING

by Barnet D. Ostrow and Fred I. Nobel, Lea-Ronal, Inc.

A discussion of the new developments in gold plating with particular emphasis on application of such processes to industrial usage. The low *p*H type acid gold baths are discussed as well as a new high speed bright cyanide gold. Graphs, photomicrographs and tables of physical characteristics are presented.

A CYANIDE BATH FOR HEAVY GOLD PLATING

by James K. Gore and Robert Seegmiller, University of California, Los Alamos Scientific Laboratory

A cyanide gold plating bath capable of producing heavy gold deposits with good physical properties at rapid plating rates and reasonable temperatures is described. Designed for use in engineering applications, the bath produces bright to semi-bright, smooth, fine-grained, hard and relatively pore-free deposits, as rapidly as 1.5 mils/hr. Although the deposits are hard they are more ductile than most commercial bright golds. Smooth deposits 20–30 mils thick are readily obtained.

ACID GOLD PLATING

by Robert A. Ehrhardt, Bell Telephone Laboratories, Inc.

An acid gold plating bath developed for plating on printed circuits is described. It includes the study of the influence of *p*H, temperature, current density and bath composition on cathode efficiency and appearance. A porosity test was developed and used to determine the influence of the physical condition of the basis metal and of the various operating parameters on the porosity of thin gold deposits.

9:00 a.m. ..... West Garden Room

SESSION D

Chairman—Dr. Richard B. Saltsonstall, The Udylite Corporation

CORROSION AND ELECTRODE POTENTIAL STUDIES OF NICKEL-CHROMIUM COATINGS

by Arthur H. Du Rose, The Harshaw Chemical Company

A corrosion protection comparison for different systems of nickel-chrome deposits is given. It is shown that "duplex" nickel has much to offer in improved protection for plated parts. The correlation among various types of exposure tests is discussed. The outdoor corrosion weight loss for bright nickel foil is only slightly greater than that for sulfide-free nickel, but the degree of perforation is much greater, and chromium intensifies the perforation. Potential, galvanic and polarization data are given for bright nickel, sulfide-free nickel and chromium.

A PROGRESS REPORT ON EXPERIENCES IN IMPROVING THECORROSION RESISTANCE OF AUTOMOTIVE PARTS

by J. D. Thomas, D. W. Hardesty and C. F. Nixon, General Motors Corporation Research Laboratories

With improvement in the corrosion resistance of decorative plated finishing systems, the CASS test has been modified, especially as to the time required for testing because in its present form

Arthur H. DuRose

James D. Thomas

Donald W. Hardesty

Cleveland F. Nixon

R. J. Clauss

William H. Safranek

Hugh R. Miller

R. W. Hardy

Dr. Harold J. Read

Dr. Richard J. Barton

as much as 100 hours has been required to produce failure. Further experience now permits better correlation of CASS results with outdoor performance, particularly for plating capable of withstanding 16 hours or more of CASS exposure without failure. Changes in plating techniques which have resulted in improved corrosion resistance are discussed.

NEW DATA ON THE PERFORMANCE OF NICKEL AND CHROMIUM PLATED ZINC DIE CASTINGS

by W. H. Safranek, H. R. Miller, R. W. Hardy, and Dr. C. L. Faust, Battelle Memorial Institute

The results of research conducted for American Zinc Institute on procedures for improving electroplated zinc die castings have shown outstandingly better corrosion performance for die castings plated with 0.8 or 1.2 mils of duplex nickel and 0.05 mil of bright crack-free chromium in place of bright nickel-ordinary chromium composites. Greater resistance to cracking during thermal cycling was another advantage shown for duplex nickel. Higher impact values were obtained for die-cast zinc alloy when bright nickel was replaced by duplex nickel. Crack-free chromium eliminated the corrosion pitting that occurred in duplex nickel-ordinary chromium composites. In this respect, outdoor weathering confirmed the results of accelerated corrosion studies.

A STUDY OF VARIATIONS IN CERTAIN CHARACTERISTICS OF BRIGHT NICKEL DEPOSITS WITH VARIATIONS IN BATH TEMPERATURE

by R. J. Clauss, The Udylite Research Corporation

The effects of operating bright nickel solutions at temperatures above 175F have been studied and certain characteristics of the electrodeposit such as microstructure, appearance and ductility are compared with the properties of deposits made at normal plating temperatures. The effectiveness of various addition agents at these temperatures is compared to their utility at today's lower operating temperatures. Analogous properties of bright nickel deposited at elevated temperatures and bright nickel-cobalt alloy deposits are also discussed.

WEDNESDAY, JULY 27

9:00 a.m. ..... Golden State Room

SESSION E

Chairman—*Dr. Harold J. Read, The Pennsylvania State University*

THE METALLURGICAL ASPECTS OF HYDROGEN EMBRITTLEMENT IN METAL FINISHING

by Dr. Harold J. Read, Department of Metallurgy, The Pennsylvania State University

The practical problems of metal damage by hydrogen are outlined with emphasis on metal finishing aspects. The nature and extent of damage are discussed. Remedies are classified according to their application, that is, as modifications of the finishing processes to prevent hydrogen occlusion or as post treatments to remove occluded hydrogen. Selection of metals and finishes for specific applications is discussed in the light of hydrogen damage problems, and metallurgical information of assistance to metal finishers who must face embrittlement problems is presented.

ON THE MECHANISM OF TRANSPORT OF HYDROGEN ACROSS A SOLUTION-METAL INTERFACE

by Dr. Richard J. Barton, Wright Air Development Division, Wright-Patterson Air Force Base

The mechanisms of hydrogen entry into and release from metals are discussed in consideration of presently accepted mechanisms for the hydrogen electrode reaction. The applicability of these hydrogen evolution mechanisms to certain solutions and metals is conisdered. These mechanisms are analyzed, using various possible migrating species, to determine at which stage deviation from the gas evolution process may occur to cause hydrogen entry into the metal. The effects of the rates of various kinetic steps, the nature of the surface films and the amount of the surface coverage are evaluated and experimental evidence is cited. The influence that mechanisms of the release process may have upon penetration studies is pointed out.

S. C. Lawrence Jr.

Dr. Cloyd A. Snavely

Norman M. Geyer

G. William Lawless

Bennie Cohen

C. C. Shepherd

Maynard L. Hill

Dr. Walter Beck

E. J. Jankowsky

Dr. W. F. Hamilton

Myron Levine

THE BEHAVIOR OF HYDROGEN IN IRON AND STEEL

by Maynard L. Hill, Westinghouse Electric Corporation Research Laboratories

Studies of the solubility and diffusivity of hydrogen in ferritic alloys have shown that the normal behavior above about 200C is for the hydrogen to dissolve interstitially. However, several pronounced deviations from this fundamental behavior have been observed at lower temperatures where embrittlement occurs. These indicate that the hydrogen no longer resides in interstitial sites, but instead, it segregates at sites of lower energy. Various possible types of segregation such as condensation around dislocations, molecular gas formation in voids, chemisorption in cracks and others are discussed along with the possible role of such segregations in the mechanism of embrittlement.

DETECTION AND CONTROL OF CHEMISORBED HYDROGEN DURING ELECTROLYSIS

by Samuel C. Lawrence Jr., Metal Physics Laboratory, Boeing Airplane Company

Instrumentation to detect and measure hydrogen entering plated parts during electrolysis is described, and data obtained from experiments employing these techniques have been applied successfully to keep chemisorbed hydrogen to a minimum. The relative importance of different "catalysts" or "poisons" on adsorption rates is shown, and proper control of voltage, temperature and other parameters allows satisfactory plating to be made with low hydrogen pickup. Adsorption during other portions of the electroplating process, such as liquid honing, cleaning, pickling, and rinsing can also be substantially reduced. These methods can be used for continuous, accurate monitoring of chemisorbed hydrogen.

2:00 p.m. ..... Golden State Room

SESSION F

Chairman—Dr. Samuel Heiman, Philadelphia Rust Proof Company, Inc.

MEASUREMENTS PERTAINING TO HYDROGEN EMBRITTLEMENT

by Dr. Cloyd A. Snavely, Battelle Memorial Institute

Measuring techniques which have been useful in hydrogen embrittlement studies are described, and their usefulness for future studies is critically examined. Included in the discussion are hydrogen charging methods, stressing methods, analytical problems, surface effects, and related phenomena. Problems in developing a standard embrittlement test are outlined.

A NEW LOOK AT THE HYDROGEN EMBRITTLEMENT OF CADMIUM COATED HIGH STRENGTH

by Norman M. Geyer, G. William Lawless, and Bennie Cohen, Materials Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base

A sensitive embrittlement test consists of a sustained loaded notched tensile specimen, loaded at 75 per cent of the ultimate notched tensile strength for a minimum of 200 hours. Detrimental hydrogen embrittlement is shown to be dependent upon the steel alloy, the current efficiency of the cadmium plating bath and the physical structure of cadmium coating obtained. Cadmium electroplating processes for coating high strength steel without detrimental hydrogen embrittlement are given.

EFFECTIVENESS OF METALLIC UNDERCOATS IN MINIMIZING PLATING EMBRITTLEMENT OF ULTRA HIGH STRENGTH STEEL

by Dr. Walter Beck and E. J. Jankowsky, Naval Air Material Center, Aeronautical Materials Laboratory

Effective reduction of hydrogen embrittlement of ultra high strength steel resulting after chromium and cyanide cadmium electroplating was achieved by pyrophosphate copper and Watts type nickel undercoats and replacement of the cyanide cadmium plating solution by the fluoborate bath. Embrittlement was evaluated by measurements of bend and tensile ductilities and sustained-loading delayed-failure tests on notched specimens. The sustained-loading test exceeds the other two procedures in sensitivity and reliability. Mechanisms were suggested for embrittlement inhibition by metallic undercoats and replacement of the cyanide by the fluoborate solution and the experimental results discussed in the light of these mechanisms.

Paul Glab

R. S. Modjeska

Simon P. Gary

Dr. D. E. Koontz

Dr. David O. Feder

Dr. Carl O. Thomas

Dr. Victor Zentner

Richard C. Barrett

Morton Schwartz

Robert J. Girard

Edward F. Koetsch Jr.

CONTROL OF HYDROGEN EMBRITTLEMENT BY PLATING FROM CADMIUM CYANIDE BATHS CONTAINING NITRATE

by Dr. W. F. Hamilton and Myron Levine, Lockheed Aircraft Corporation, California Division

A modification of the conventional electroplating process has been developed by which the plating of high strength steel parts can be satisfactorily accomplished without harmful hydrogen embrittlement. Addition of sodium nitrate and a throwing power additive to a high cadmium, low free-cyanide electrolyte produces satisfactory operating characteristics without visible cathodic gassing. The need for post plate baking is eliminated. A new cleaning procedure has been developed for use with the modified electrolyte and the operation, control, testing and results of the process are given.

7:30 p.m. ..... Los Angeles Room

ROUND TABLE SESSION

Chairman—Dr. Harold J. Read, The Pennsylvania State University

HYDROGEN EMBRITTLEMENT IN METAL FINISHING

THURSDAY, JULY 28

9:00 a.m. ..... Golden State Room

SESSION G

Chairman—Dr. Abraham M. Max, RCA Victor Record Division, Radio Corporation of America

MAGNETIC PROPERTIES OF ELECTRODEPOSITED COBALT ALLOYS

by Dr. Victor Zentner, Hughes Aircraft Company

The performance of permanent magnets depends primarily on the magnitude of the coercive force and remanence of the magnetic material. The correlation of these two properties with plating conditions in electrodeposited cobalt-nickel and other binary cobalt alloys were investigated. Photographs of hysteresis curves taken with the aid of a B/H loop tracer which displays these curves visually on an oscilloscope show the influence of conditions of deposition on these magnetic properties. Corroborative evidence for the magnetic behavior of these alloys is shown by saturation curves obtained by plotting writing currents for signals at various frequencies against readback voltage. Preferred conditions of deposition for producing alloys with desirable magnetic properties have been established.

PLATING OF NICKEL, COBALT, IRON AND CADMIUM FROM SULFAMATE SOLUTIONS

by Richard C. Barrett, Barrett Chemical Products Company

Technical data are given on the application and properties of nickel electrodeposited from sulfamate solution, with particular emphasis on high temperature applications of deposits, special magnetic properties of nickel-cobalt and nickel-iron alloys. Hydrogen embrittlement aspects of cadmium deposition at 100 per cent cathode efficiency in sulfamate plating baths are discussed. Bath formulae and operating conditions covering the electrodeposition of cobalt, iron, and cadmium from sulfamate solutions are included.

THE CHEMICAL REDUCTION OF NICKEL-PHOSPHORUS ALLOYS FROM PYROPHOSPHATE SOLUTIONS

by Morton Schwartz, Kelite Corporation

New electroless nickel solutions using pyrophosphate complexing agents have been developed. These alkaline pyrophosphate solutions can be operated at temperatures lower than normally employed, with higher deposition rates. The solutions are stable and easily maintained and controlled. Deposition rates of 0.5 to 0.7 mil/hr have been obtained at 68 to 74C. The composition of the deposit is constant at 5 per cent phosphorus over a wide range of operating conditions. The effects of the important variables are discussed.

9:00 a.m. ..... West Garden Room

SESSION H

Chairman—Francis T. Eddy, TEL-autograph Corporation

SOLUTION TRANSFER IN BARREL PLATING

by Paul Glab, R. Scott Modjeska and Simon P. Gary, Scientific Control Laboratories, Inc.

Results are presented of a study of solution changes within a plating barrel occurring during the plating period and the effects of those changes in deposit characteristics, plating rates, etc. A barrel is immersed in clear water with a soluble dye added to the barrel. Color dilution measurements show quantitative rate of solution transfer. Types of loads, perforation sizes and barrel speeds are varied. Studies in actual production in cadmium, copper, nickel, silver, tin, zinc, and brass show metal ion concentration variation within the barrel from start to cycle completion.

CLEANING TECHNIQUES IN THE ELECTRONICS INDUSTRY

by Dr. D. E. Koontz, Dr. D. O. Feder and Dr. C. O. Thomas, Bell Telephone Laboratories, Inc.

Trace amounts of extraneous materials may significantly influence either the electrical characteristics or the feasibility of fabrication of modern electronic devices. Current trends in the electronics industry which have created a need for more effective control over both the type and amount of residual contaminants are described. Contaminants are classified and examples are presented of their effects on the performance of typical devices. Practical techniques developed for the detection, removal and control of contaminants are described. Cleaning techniques and their integration into typical cleaning cycles of interest to electroplaters are presented.

CHROMIUM PLATING OF RIFLE BARRELS

by Robert J. Girard and Edward F. Koetsch Jr., Springfield Armory

The process for chromium plating the M14 barrel has advanced to a production stage at Springfield Armory. This paper discusses the methods employed in the development and adaptation of a process to electropolish and chromium plate the entire bore and chamber of the M14 Springfield Rifle. Electropolishing and chromium plating processes are outlined, including processing equipment and procedures, bath compositions, fixture design and maintenance, semiautomatic bore-cleaning operations, gaging of barrels, time guides for controlling electropolishing and chromium plating, and the relationship of viscosity and temperature to the degree of taper obtained during electropolishing.

2:00 p.m. ..... **Golden State Room**

SESSION I

Chairman—Maurice R. Caldwell, Doehler-Jarvis Division, National Lead Company

AES RESEARCH—ITS PURPOSE AND ACCOMPLISHMENTS

by J. D. Thomas, 1959–1960 Chairman, AES Research Committee

The reasons for sponsoring research, the aims in selection of areas to be studied, and benefits to be gained are discussed. Financial support is obtained from Active Members, Sustaining Memberships, and donations from Branches and other Societies. A brief review is given of the presently active projects and those which have been completed. What the future promises is contemplated in view of the rapid changes taking place in the metal finishing industry.

CORROSION PROTECTION WITH DECORATIVE CHROMIUM

by Dr. E. J. Seyb, Metal & Thermit Corporation

During recent years there have been dramatic advances in the concept of chromium's role in corrosion protection with copper-nickel undercoats. Previously, chromium was not considered in providing corrosion protection, and was used primarily for tarnish resistance. It is now recognized that chromium is a major factor in providing improved corrosion protection. The improvement is obtained by means of greater thicknesses of crack-free or duplex chromium. These different chromium deposits are discussed, and their corrosion protection illustrated by accelerated and outdoor exposure tests. Industrial applications are described.

EXPERIENCE IN THE OPERATION AND PERFORMANCE OF DUAL CHROMIUM SYSTEMS

by W. E. Lovell, E. H. Shotwell and James Boyd, Ternstedt Division, General Motors Corporation

Dual chromium plating has been practiced on a production scale for about two years, and is shown on the basis of accelerated and outdoor exposure tests to provide markedly improved corrosion resistance over the single chromium system formerly used. Methods of applying dual chromium, and problems encountered, are discussed. Theory explaining the improvement in corrosion resistance obtained by dual chromium is developed, including illustrations of desired crack patterns, potentials of electrodeposited metals and techniques used for their measurement, and the mechanisms of corrosion in single and dual chromium systems.

Dr. Charles L. Faust

Dr. E. J. Seyb

William E. Lovell

Eldon H. Shotwell

James Boyd

CONVENTION CHAIRMEN

Mrs. Glen J. Beckwith
Ladies

Tony Stabile
Chairman

George J. Hetz
Vice Chairman

Walter P. Behlendorf
Finance

Lawrence M. Henderson
Hotel

L. Truman Stoner
Outing

Harvey K. Hunt
Plant Visits

E. W. Wells
Publicity

C. Phillip Simon
Registration

Lawrence O'Neil
Entertainment

Eugene Bosl
Children

John D. Millhorn
Program

Earl W. Arnold
Educational Sessions

G. Stuart Krentel
Printing

Mrs. Alice M. Prescott
Secretary

William P. Thomas
Banquet

Norman F. Painter
Housing

AMERICAN ELECTROPLATERS' SOCIETY CONGRATULATES AND THANKS

THE EXCLUSIVE mission of American Electroplaters' Society, Inc. (AES), for five full fruitful decades, has been, and continues to be, the advancement of electroplating, metal finishing and allied arts through the enrichment of knowledge. Like every other AES National Convention since the first as such held in 1913, the principal purpose of the AES's 47th Annual Convention being held in Los Angeles, July 24–28, 1960 is to share technical and scientific knowledge in plating, metal and organic finishing and allied arts.

ASIDE FROM an Educational Sessions Program expected to be among the most significant in AES's long convention history, the 47th Annual Convention has marshaled an array of "off duty hour" programs of relaxation, fellowship and entertainment expected to compare favorably with any previous AES Convention, particularly since these events are to occur against Los Angeles' unique vacationland background.

TO THE state, municipal and civic leaders of California and Los Angeles who are welcoming AES to their great state and city, July 24–28—to the officers and members of the Society's Los Angeles Branch that is hosting this large AES enterprise—to the fine industrial companies that have advertised in this Western Issue of PLATING MAGAZINE and/or that are providing hospitality at the Convention—to the leadership and personnel of the Host Branch Convention Committee—to the executives and staff of the Statler Hotel and other Los Angeles hostelries that are housing the Society's large numbers—to these, plus the learned men who will share their knowledge with AES's members attending the Educational Sessions, the Supreme Society, the Executive Board. National Headquarters and PLATING MAGAZINE express a hearty "thank you."

AND TO AES's attending membership, may your cup overflow with technical and scientific knowledge, and may you have much fellowship and fun in America's West Coast "Wonder City," July 24–28, 1960, AES Convention style.

REMINDERS TO AES CHARTERED BRANCHES

1. YOUR BRANCH MEMBERSHIP ROSTER
A complete, up-to-date list of the names and correct current addresses of your Branch Members as of June 30, 1960 is due at National Headquarters by or before July 15, 1960 so as to enable the National Office to bill your Branch for Per Capita Taxes for the 1960-1961 fiscal year (July 1, 1960-June 30, 1961) as promptly after the list's arrival at Headquarters as possible. (AES Bylaws, Part II, Article V, Section 4).

2. YOUR BRANCH PER CAPITA TAX PAYMENT
Due date for the payment in full by your Branch of its 1960-1961 Per Capita Taxes is SEPTEMBER 1, 1960. (AES Bylaws, Part 1, Article V, Sections 1, 2 and particularly 3).

3. YOUR BRANCH DELEGATES AND ALTERNATES
The list of your Branch's duly elected Branch Delegates and Alternate Delegates for 1960-1961 is due in the hands of the National Executive Secretary by or before November 7, 1960. The tenure (term of office) of these elected Delegates and Alternates is from the FIRST Branch meeting immediately following the 1960 Annual Meeting of the Supreme Society (Los Angeles, July 28, 1960) to the first Branch Meeting immediately following the 1961 Annual Meeting of the Supreme Society (Boston, June 23, 1961) or until their successors are duly elected by your Branch. Your list should be filed on the official form that will be provided to you in proper time by National Headquarters, and be signed by both the Branch President and Branch Secretary (AES Bylaws, Part II, Article VII, Section1).

4. YOUR BRANCH NEWS
Branch News is required of all Branch Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's readership.

5. BRANCH'S ELIGIBILITY FOR PER CAPITA TAX CREDIT
As reported in the April 1960 issue of PLATING MAGAZINE, the following policy was enacted by the Executive Board at its Philadelphia meeting, February 19, 1960:

a) A copy of the fiscal year's TECHNICAL PROCEEDINGS, a voluminous and expensive AES book, is to issue to each Branch member listed on the official membership records of National Headquarters as being in "good standing" on November 1, "good standing" meaning that the fiscal year's Per Capita Tax has by then been paid for him by his Branch.

b) No copy of said book is to be issued to any Branch member listed as suspended, died or resigned on an official notification received by National Headquarters by or before November 1 from any Branch. Hence, if full Per Capita Tax has already been paid by the Branch for said fiscal year on him, said Branch will be eligible for usual credit or refund on the schedule governing.

c) No Per Capita Tax credit or refund for the fiscal year, conversely, is to be allowed hereafter to any Branch for any Branch member resigned, died or suspended to whom National Headquarters has issued a copy of that year's TECHNICAL PROCEEDINGS by virtue of not having received such official notification from said Branch by or before November 1.

6. NATIONAL OFFICER VISITS TO YOUR BRANCH
Reported at the SEVENTH INTERIM MEETING of the Supreme Society held in Philadelphia, February 20, 1960, as well as in the April 1960 issue of PLATING MAGAZINE, was the statement of policy as regards National Officer visits to AES chartered Branches enacted by the Executive Board at its Philadelphia meeting, February 19:

If YOUR Branch or Region desires any particular National Officer to attend any special or regular meeting of your Branch or Region for the purpose of serving as Chairman of the Educational Session, or addressing your Banquet, or installing your Officers or for any other such mission, please send your invitation direct to him at your earliest convenience (A list of the names and addresses of the six National Officers appears in each monthly issue of PLATING MAGAZINE). To the extent possible, practicable and not in conflict with his business duties or personal commitments, each such invitation will normally be favorably considered, but entirely on a "first come, first served" basis.

AES Convention Directory

1960—
47TH ANNUAL CONVENTION
July 24-28, 1960
Los Angeles, California
Statler Hotel
Host Branch: Los Angeles
General Chairman:
Mr. Tony Stabile, President
Associated Plating Co., Inc.
417 East 16th Street
Los Angeles 15, California
Co-Chairman:
Mr George J. Hetz
C & W Metal Finishing, Inc.
3525 S. Greenwood Avenue
Los Angeles 22, California

1961—
48TH ANNUAL CONVENTION
June 18-23, 1961
Boston, Massachusetts
Statler Hotel
Host Branch: Boston
General Chairman:
Mr. Louis V. Gagnon
P. O. Box 329
Framingham, Massachusetts

1962—
49TH ANNUAL CONVENTION
June 25-28, 1962
Schroeder Hotel
Milwaukee, Wisconsin
Sponsor: Midwest Regional Council
Host Branch: Milwaukee
General Chairman:
Mr. Herman Tessmann
3864 South 57th Street
Milwaukee, Wisconsin
Assistant Chairmen:
Mr. Eugene Roth
Roth Plating Corporation
739 North College Street
South Bend, Indiana
Mr. Leonard Weeg
National Lock Company
Rockford, Illinois

1963—
50TH ANNUAL CONVENTION
June 24-27, 1963
Ambassador Hotel
Atlantic City, N. J.
Host Branch: Newark
General Chairman:
Dr. D. Gardner Foulke
455 Johnston Drive
Watchung R.F.D. #3
Plainfield, N. J.

1964—
51ST ANNUAL CONVENTION
June 15-18, 1964
(Hotel to be announced)
St. Louis, Missouri
Host Branch: St. Louis
Acting Chairman:
Mr. Anthony P. Julius
5620 Itaska Street
St. Louis 9, Missouri

1965—
52ND ANNUAL CONVENTION
June 28-July 1, 1965
Statler Hotel
New York, N. Y.
Host Branch: New York
General Chairman:
Mr. Milton Nadel
162-41 Powells Cove Blvd.
Whitestone 57, New York

AES NEWS

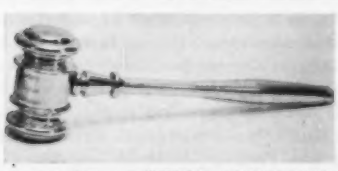
Richard C. Barrett

R. C. BARRETT CANDIDACY FOR AES THIRD VICE PRESIDENT ANNOUNCED

The candidacy of Richard C. Barrett (Bridgeport Branch), President, Barrett Chemical Products Company, for the office of Third Vice President of American Electroplaters' Society, Inc. has just been announced. Accordingly, his name along with at least three previously announced aspirants of other Branches for that national office will reportedly be placed into nomination at the Annual Meeting of the Supreme Society to be held in Los Angeles, July 28, 1960.

A native of Portland, Oregon and educated in Chemical Engineering at the University of California, Mr. Barrett is equipped with an engineering and management record in industry. During World War II, moreover, he served the U. S. Signal Corps as Civilian Engineer specializing in airborne radar design and maintenance. Currently President and Director of Research of his company, he is additionally a consultant on electronic and electrochemical applications for others.

Long a Bridgeport Branch member, Mr. Barrett has served it as a Delegate, Branch officer and Board of Managers member. He is Co-Chairman of the AES' Eighth Interim Meeting that will be held in Hartford in 1961 hosted by the New England Regional Group.



One of AES's two FIFTIETH ANNIVERSARY gold plated gavels to be used at 47th Annual Convention.

AES CONVENTION NEWSPAPER TO PUBLISH CONVENTION NEWS YOU'LL WANT TO READ

For a quarter century, AES members, their families and their guests attending the Society's Annual Conventions have been greeted each Convention morning by a copy of the AES's Convention daily newspaper, "H-VW-M Official Convention News". The happy tabloid has reported on events, people, happenings and doings on the Convention scene. At the Los Angeles Convention, the paper will be on duty to help make that four-day AES assembly as effective as its predecessors.

"H-VW-M", of course, stands for Hanson-Van Winkle-Munning Co., and that Company, through O. S. Tyson & Co., its advertising agency, has created and furnished that well-liked gazette since the Bridgeport Convention in 1935, as a service to AES and AES members, so many of whom are H-VW-M customers.

To the Company itself and to each of its tireless editors and reporters, AES extends hearty appreciation for its more than a quarter-century delightful relationship with "H-VW-M Official Convention News".

AES LAPEL BUTTONS

The AES members handsome silver lapel button can be purchased from your Branch Secretary at $1.38 per button.

BOGGESS GAVEL FOR RETIRING NATIONAL PRESIDENT

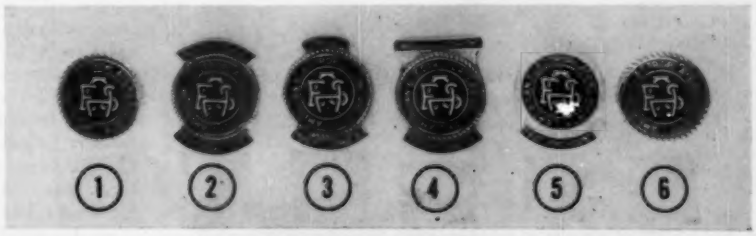
For as many years as silver gavels have been presented to retiring AES National Presidents on that day that each stepped down from the AES helm, each year's gavel has been plated and presented to the Society for that purpose by one man, namely T. R. "Ted" Boggess, Founder and First President of the Society's Blue Ridge Branch.

To this stalwart of Vinton, Virginia, AES and PLATING MAGAZINE extend hearty thanks for this year's gavel to be presented to National President Wysong on July 28, 1960.

FIRST PROCTOR AWARD READY FOR PRESENTATION

For the first time since inaugurated in June 1959, the AES's new Charles Henry Proctor Memorial Leadership Award will this year be bestowed. It will be presented at the Farewell Banquet of the 47th Annual Convention of the AES to be held in Los Angeles on Thursday evening, July 28.

Selected by a seven-person Selection Committee headed by the National President and including the donors, the honor will not only comprise a $150 cash award but also a handsome laminated scroll. Donors are Mr. and Mrs. William O. Preston of Madison, N. J., son-in-law and daughter respectively of AES's Founding Father, Charles Henry Proctor.



THE BUTTONS AND PINS OF AES

At extreme right (6) is the lapel button (silver) of members of AES, the very muscles and sinews of the Society. Next to it (5) is the Branch Past Presidents button (silver). To its left (4) is the button (gold) of AES Honorary Members (there are thirteen currently living). Further left (3) is the button (gold) worn by AES Past National Presidents. Each National President receives his at the Annual Meeting at which his successor is elected and installed. To its left (2) is the button (gold) worn by the six National Officers during their tenure. And at extreme left (1) is the diminutive pin (gold) presented by the Society to the incoming National President's wife at the Convention Banquet on the evening of her husband's election and installation as the Society's titular head.

VICE PRESIDENT NIXON RECEIVES ELECTROPLATED GAVEL

When T. R. Boggess, Blue Ridge Branch, was recently invited to visit Vice President Richard M. Nixon at his office in Washington, he presented the Vice President with a gavel which he had copper and silver plated, and Carl Witherspoon, also Blue Ridge Branch, had gold plated. (Above) Congressman Richard H. Poff, right, of the Sixth Virginia District. Mr. Boggess reports Mr. Nixon was interested in the educational and research mission of AES and showed knowledge of it.

LOS ANGELES BRANCH WINS 1959-1960 MEMBERSHIP EXPANSION COMPETITION

The Los Angeles (First Division) and Phoenix (Third Division) Branches prevailed in their respective divisions in the AES Annual Branch Membership Expansion Competition for the 1959–1960 AES fiscal year. The San Francisco and Rochester Branches ended in a tie for the leadership of the Second Division.

Accordingly, an award of $50 will be presented at the AES 47th Annual Convention, Los Angeles, to each of the First and Third Division winners for achieving the greatest net membership expansion during the 1959–1960 AES fiscal year in their respective divisions. The San Francisco and Rochester Branches will share the $50 award for supremacy in the AES's Second Division.

For the 1959–1960 fiscal year (according to records on hand at National Headquarters on May 31, 1960 in conformity with Executive Board action), the five leaders in the AES's respective divisions were:

BRANCH	Members July 1, 1959	New Members	Net Change Membership (See Important Note)	Per Cent Change
FIRST DIVISION (126 members and over)				
1. Los Angeles	278	49	+40.5	+14.6
2. Indianapolis	130	25	+17.5	+13.5
3. Melbourne	159	7	+ 6.0	+ 3.8
4. Philadelphia	241	34	+ 9.0	+ 3.7
5. Bridgeport	143	15	+ 4.0	+ 2.8
SECOND DIVISION (70-125 members)				
1. San Francisco	84	25	+ 6.0	+ 7.1
2. Rochester	84	6	+ 6.0	+ 7.1
3. Providence-Attleboro	96	13	+ 4.5	+ 4.7
4. St. Louis	109	16	+ 4.5	+ 4.1
5. Buffalo	106	13	+ 2.5	+ 2.4
THIRD DIVISION (10-69 members)				
1. Phoenix	27	14	+13.0	+48.1
2. Allentown-Reading	37	11	+ 9.0	+24.3
3. Miami	38	20	+ 9.0	+23.7
4. Dallas-Ft. Worth	58	14	+13.0	+22.4
5. Blue Ridge	35	12	+ 5.0	+14.3

NOTE: After reconciling "New," "Reinstated" and "Transferred In" members with "Resigned," "Suspended," "Died" and "Transferred Out" number. Net change is computed by rating "Transfers" at .5.

FALL MIDWEST REGIONAL CONFERENCE AT NOTRE DAME

The Second Annual Conference of the AES Midwest Regional Council will be held on October 29 at the University of Notre Dame, South Bend, Indiana. St. Joseph Valley is the Host Branch.

The St. Joseph Valley local committee chairmen are Dr. Ernest J. Wilhelm, facilities; John Bayman, luncheon; Sam Alfano, hospitality; Ralph Brouwer, publicity; Henry A. Meers, luncheon speaker; Louis Rague, exhibits. Simon P. Gary, Chicago Branch, is educational chairman, and his committee is composed of the librarians of all six Branches comprising the Midwest Regional—Chicago, Milwaukee, Rockford, St. Joseph Valley, Mississippi Valley and St. Louis.

The format of the program and a tentative slate of speakers were decided at a meeting on May 14 attended by Si Gary, Chicago, chairman; Curtis E. Hunsaker, Milwaukee; Harold E. Ellis, Robert Campbell and Murray E. Rounds, Rockford; Robert L. Aikin, John F. Devendorf, Jack W. Peterson and Louis Rague, St. Joseph Valley.

Registration will start at 9:30 a.m. The morning session is scheduled for 10:00 o'clock in the Engineering Auditorium. Lunch will be in the Mahogany Room at the Morris Inn.

In the afternoon there will be three workshops covering mechanical finishing, electroplating and organic finishing.

Paul F. Glaser

SATELLITE STAR TO ADDRESS LOS ANGELES CONVENTION

Paul F. Glaser, Project Engineer for Pioneer V, the solar satellite, and for Explorer VI, the "Paddlewheel" satellite, will be the keynote speaker at the Grand Opening Session of the 47th Annual Convention, American Electroplaters' Society, Inc., at the Statler Hotel, Los Angeles, California, Monday forenoon, July 25.

Mr. Glaser is associate manager, system engineering department, Experimental Space Projects, Research and Development Division, of Space Technology Laboratories, Inc., El Segundo, California.

MINUTE MAN—This statue may be seen by the visitor to Greater Boston when he journeys to Concord to visit the scene of "the first shot that was heard 'round the world."

NEXT JUNE: AES NATIONAL CONVENTION BOSTON

THE rotation of AES national conventions has swung eastward, and in 1961, the Society's convention will be staged in an eastern metropolis, namely historic Boston. Assuming the convention mantle from Washington, 1956; Montreal, 1957; Cincinnati, 1958; Detroit, 1959 and Los Angeles, 1960, the Society's Boston Branch will conduct the 1961 four-day assembly, June 18-23, at the Statler Hotel in the Massachusetts capital city that is the great cultural, industrial, fishery and wholesale center of New England.

Filled with historic memorials and named in America's long, long ago after the "Boston" of Lincolnshire, England, AES's 1961 convention municipality is the bellwether of the Commonwealth whose tree is the stately elm, whose bird is the late W. C. Field's famed Chickadee, and whose motto is "Ense Petit Placidam Sub Libertate Quieten" (By the Sword She Seeks Peace, but Peace Only Under Liberty).

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IN '61, the year that the Boston Branch will be hosting its third AES national convention, that thriving AES chartered affiliate will itself be observing its Fortieth Anniversary as a Branch of the Society. Founded in 1921 when the AES numbered 21 Branches and had an aggregate membership of about a thousand members, Boston has since surged numerically to about eighth place in stature in the family of AES's 58 Branches. Having conducted the AES national conventions of 1941 and 1950, it is a veteran in staging successful large assemblies of burgeoning AES.

General Convention Chairman is dynamic Louis V. Gagnon of Enthone, Inc., a New Englander who, for years, has been one of the towers of strength of the Boston Branch. He has surrounded himself with departmentized leadership that is worthy of the Boston Branch.

CONCENTRATION is, of course, upon programming outstanding educational sessions—and leading that element of the 1961 AES Boston Convention, under the supervision of the AES Editorial Board that has the responsibility for Convention educational sessions, is the able George J. Marotta. A versatile program covering all phases of the plating and metal finishing and organic coating gamut, the Boston educational program, at this writing, will also feature the Third William Blum Lecture plus a symposium on "Finishing of Light Metals."

Aside from a high-quality educational program, the 1961 Convention will include an important array of plant tours—an imaginative ladies' and children's program in a colorful city packed with sightseeing treats—and many dividends by way of entertainment and relaxational events, possibly including some Boston Tea Parties.

In the city evacuated by British General Howe in 1776, the cares and anxieties of AES members and their families and guests will be "massacred" 1770 style at the AES Convention in 1961. Plan now to be among those present to receive the full Boston treatment, broad "a" plus.

Everyone who visits "Old Ironsides" in the Charlestown Navy Yard in Boston takes a souvenir snapshot of the old frigate. The sailing ship has been restored to its exact condition when it fought so nobly in the War of 1812.

INTERSOCIETY NEWS

MFSA ANNUAL MEETING IN LOS ANGELES

The Metal Finishing Suppliers' Association will hold its annual meeting at the Statler Hilton Hotel, Los Angeles, California, simultaneously with the American Electroplaters' Society convention, July 24 to 28.

On Sunday, July 24, brunch in the morning will be followed by a meeting of the board of trustees. A heavy agenda will be considered and a special attendance effort has been requested. At noon on Monday, luncheon will precede the annual meeting in the Sierra Room. That same evening the MFSA ball will be held in the Pacific Ballroom and Sierra Room, with continuous music for dancing. Refreshments and snacks will be served. Admittance will be by AES registration badge and for late comers there will be registration facilities on the ballroom floor.

The annual golf tournament sponsored by the Association will start at 8:30 a.m. on Tuesday and is scheduled to be held at Los Coyotes Country Club in Buena Park. Greens fees are $5.00. The ladies are invited to participate. Prizes will be awarded for skill and luck. The golf chairman is R. M. Burford Jr. The golf committee will handle registration in the convention registration area, where directional maps will be available.

A cocktail party will be given on Thursday evening between 5:50 and 6:50 o'clock in the Wilshire Room. Admission by AES registration badge only.

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NAMF MANAGEMENT MANUAL FOR MEMBERS

The National Association of Metal Finishers has announced the publication of an industry management manual. According to Edward N. Marlette, Marlette Plating Co., Buffalo, N. Y., NAMF educational chairman, the more than 200-page compendium of metal finishing know-how is being prepared exclusively for members of the National Association of Metal Finishers. It will be released at the NAMF annual convention this July in Los Angeles, according to the announcement.

Sample of the manual's contents: operating costs, cost determination methods, plating specifications covering ten classes, including appliance and aircraft industries, trade practices, code of ethics, first aid practices, shop practices, shop and office forms, personnel practices, public relations, polishing and buffing, charts, graphs, tables, salary and wage information, polishing and buffing data, and more.

For further information, write: National Association of Metal Finishers, 11 Park Street, Montclair, New Jersey.

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ASM PENNSYLVANIA INTERCHAPTER MEETING AT PENN STATE

On Friday and Saturday, Sept. 9 and 10, 1960, the Penn State Chapter of the American Society for Metals and the Metallurgy Department of the Pennsylvania State University will be hosts to the six ASM Chapters in Pennsylvania for the 12th Biennial Interchapter Meeting.

The theme of the technical program, arranged by a committee of representatives from all the participating Chapters under the chairmanship of Dr. R. W. Lindsay of Penn State, will be a study of "Applications of Basic Research in Metallurgy." The papers to be presented during the technical sessions will review recent developments in such fields as electrical conductivity, thermoelectric power, magnetic properties, mechanical properties, and extractive metallurgy. But most significantly, each author will show how the results of basic research in each of these fields is being applied in modern metallurgical practice and in the development of new products and devices.

A banquet and nontechnical program of entertainment are being arranged for Friday night, Sept. 9, and ladies will be welcomed at this event. Informal entertainment for the ladies will be provided on Friday afternoon and Saturday morning.

All inquiries concerning the Interchapter Meeting should be directed to the secretary of the Penn State Chapter of the ASM, Dr. Harold J. Read, Room 8, M. S. Bldg., Penn State University, University Park, Pennsylvania.

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NACE WILL HOLD SIX MEETINGS IN FALL

Corrosion engineers will hold five meetings in the United States and one in Canada this fall to hear technical papers and to discuss corrosion problems. The conferences will be sponsored by National Association of Corrosion Engineers. In addition to the conferences, short courses will be held in Ohio, Oklahoma and California.

Locations and dates of NACE regional conferences are: Western, San Francisco, Cal., Oct. 6–7; Southeast, Atlanta, Ga., Oct. 6–8; Northeast, Huntington, W. Va., Oct. 11–14; North Central, Milwaukee, Wis., Oct. 19–20; South Central, Tulsa, Okla., Oct. 25–27; Canadian, (Eastern Meeting) Montreal, Que., Nov. 14–16.

The short courses will be jointly presented by NACE and universities in Ohio, California and Oklahoma. Short course schedule is: Ohio State, Columbus, Ohio, Sept. 12–16; U. of Cal., Berkeley—U. of Cal., Los Angeles, held in San Fraacisco, Oct. 3–5; U. of Okla., Oct. 3–5, Norman, Okla.

More information on the conferences and courses may be obtained from the National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2, Tex.

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ASM METAL SHOW WILL BE INDUSTRY SHOWCASE

Sixteen firms representing the largest concentration from the steel industry in the 42-year history of the ASM Metal Shows already have reserved display space for the 1960 event, Oct. 17–21 in the Philadelphia Trade and Convention Center.

Along with this heavy steel industry participation, leading firms in many other areas of the metal industry have reserved major display spaces in the 1960 Metal Show.

Accentuating the dynamic quality of the Exposition will be the 42nd National Metal Congress, held concurrently with the Metal Show. Its projected 250 technical papers, panels and symposia will be carefully selected to present the most significant developments in metal science and engineering during the past year.

In addition to steel, the 1960 Philadelphia Metal Show exhibitors will represent ten other metalworking categories to generate a definite "metals personality and atmosphere" in the Metal Show. Others are: Non-ferrous metals, related engineering materials, nuclear materials and equipment, tool materials for cutting off and forming, industrial heating, cleaning and finishing, welding and joining, testing, inspection and control equipment, production and casting, parts, forms and shapes for design.

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PRODUCTION ENGINEERING SHOW TO DOUBLE EXHIBIT SPACE

The Production Engineering Show, held every five years to coincide with the Machine Tool Show, will have about 50 per cent more exhibitors and occupy about 100 per cent more exhibit space than it did in 1955.

Both shows will be held in Chicago from Sept. 6 through 16. Exhibit space at the Machine Tool Show, which will be held at the International Amphitheatre, is re-

AES RESEARCH PROJECT REPORTS CURRENTLY AVAILABLE

Cleaning and Preparation of Metals for Electroplating, IV, V, VI & VII—By H. B. Linford & E. B. Saubestre — *Serial 26, Project 12, $3.50*

Methods for Testing Thickness of Electrodeposits, II & III—By H. J. Read & F. R. Lorenz — *Serial 27, Project 7, $1.35*

Porosity of Electrodeposited Metals—By N. Thon, D. G. Kelemen, L. Yang, S. Yang, D. Dean — *Serial 28, Project 6, 85 Cents*

The Analysis of Electroplating Solutions for Major Constituents—By E. J. Serfass & M. H. Perry — *Serial 29, Project 2, 90 Cents*

Effect of Basis Metal Condition on Plating, I & II By A. E. R. Westman & A. F. Mohrnheim — *Serial 30, Project 14, $1.10*

Effect of Surface Finishing on Nonferrous Base Metals on Protective Value of Plated Coatings—By G. J. Kahan, W. W. Macchia, J. M. Fairbank — *Serial 31, Project 4, 45 Cents*

How the Small Electroplater Can Treat Cyanide Plating Waste Solutions with Hypochlorites—By Bernett F. Dodge and Walter Zabban, Yale University, New Haven, Connecticut — *Serial 33, Project 10, 50 Cents*

Effects of Impurities and Purification of Electroplating Solutions, IX, X & XI—By Dr. D. T. Ewing, Dr. A. J. Smith & Dr. W. O. Dow — *Serial 34, Project 5, 50 Cents*

Cleanability and Oil Spreading Rates—By H. B. Linford & P. E. Grubb — *Serial 35, Project 12, 50 Cents*

The Nature, Cause and Effect of the Porosity in Electrodeposits, I & II—By Fielding Ogburn, Asaf Benderly and Margaret Hilkert — *Serial 36, Project 13, $1.00*

Microthrowing Power, A Literature Search—By Esther B. Leffler and Henry Leidheiser Jr. — *Serial 37, Project 17, 75 Cents*

The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating IV—By M. H. Jones, Chih-Yeu Lu and J. Zajdowski — *Serial 38, Project 14, $1.25*

Mechanical Finishing of Metal Surfaces—Bibliography—By C. E. Kennedy, J. E. Fritts, R. S. Modjeska, L. E. Weeg & R. V. Twyning — *Serial 39, Project 18, 50 Cents*

The Nature, Cause and Effect of the Porosity in Electrodeposits, III, IV & V—By Fielding Ogburn, D. W. Ernst & W. H. Roberts — *Serial 40, Project 13, 50 Cents*

An Introduction to Fundamental Research on the Mechanism of the Electrodeposition of Metals—By B. E. Conway and J. O'M. Bockris — *Serial 41, Project 16, $1.00*

Cleaning and Preparation of Metals Prior to Electroplating, VIII, IX, X & XI—By H. B. Linford, D. O. Feder & A. Venkateswarlu — *Serial 42, Project 12, $1.75*

Cleaning and Preparation of Metals Prior to Electroplating, XII—By H. B. Linford & J. J. Grunwald — *Serial 43, Project 12, 50 Cents*

The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating, VI—By M. H. Jones, Chih-Yeu Lu, A. F. Mohrnheim & J. Zajdowski — *Serial 44, Project 14, $1.50*

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stricted to association members producing machine tools. Exhibits at the Production Engineering Show, to be held at Navy Pier, are open to exhibitors whose products support prime production tools.

At the 1955 Production Engineering Show there were about 200 exhibitors but there are expected to be about 300 this year. With most companies taking larger space, the exhibit area will be about double the size it was five years ago.

Among the varied products to be shown in the exhibits will be:

Control equipment: Metering and monitoring devices; quick-disconnect, shutoff and pressure-relief devices; remote controls including mechanical arms, built-in conveyors, optical viewing devices, and signaling and recording equipment. Machine components, auxiliary equipment and supplies, intraplant communications, materials handling equipment.

Inspection, gauging and testing equipment: Thickness gauges, including electrical, x-ray and beta ray; height-of-fill gauges; flaw detection equipment including ultrasonic, x-ray, and fluorescent pigment; measuring devices including optical, mechanical and electrical, and tensile and hardness testing devices.

Special production equipment: Grinding and polishing equipment; heat treating and hardening equipment including furnaces, induction heaters and explosive-hardening units; parts-cleaning equipment including mechanical, ultrasonic and abrasive blasting; waste-disposal equipment including fume-removal hoods, conveyors and scrap balers; electroplating, electropolishing and chemical milling equipment, and vacuum plating equipment.

♦

NAMF HEADQUARTERS NOW IN MONTCLAIR, N. J.

On June 1, the National Association of Metal Finishers and the NAMF-owned *Plating Management* magazine occupied new and larger headquarters at 11 Park Street, Montclair, N. J. The phone number remains the same. The circulation department of *Plating Management* will remain in Cedar Grove, N. J. temporarily before being relocated.

The move will not affect the secretary-treasurer's office which will continue in Woodside, L. I., N. Y., under the direction of Frank Kaiser of Long Island Mechanical Plating Co., Inc., and NAMF accountant George Wirth, also of that Long Island firm.

♦

SUBJECTS SELECTED FOR DIE CASTING CONGRESS

The Society of Die Casting Engineers has selected subjects for the Technical Congress to be held in conjunction with the First National Die Casting Exposition and Congress to be held in the Detroit Artillery Armory from Nov. 8–11.

The Technical Congress will include eight separate sessions. One session will be held from 9:30 a.m. to 12:00 noon and the other from 1:30 p.m. to 4:00 p.m. in the Artillery Armory on each of the four days of the exposition. Each of the sessions will have a minimum of three technical papers and/or panel discussions of the subject involved.

The subjects for the sessions have been carefully selected based on a recent industry survey of specific interests. This survey revealed an extremely high interest in the areas of die design and vacuum die casting. Other subjects in which die casting engineers showed great interest were: Anodizable die castings, die steels, die casting equipment, finishing of die castings, lubricants, automation, quality control, and die casting alloys.

♦

NAMF SURVEYING OPERATING COSTS

More than 2500 job metal finishing firms in the United States and Canada were recently asked to take part in the annual operating cost survey by the National Association of Metal Finishers. This announcement was made by Edward N. Marlette, NAMF educational chairman, and general manager of Marlette Plating Co., Buffalo, N. Y.

The survey asks for percentages of net sales for the year 1959 on 21 key items and such additional information as types of operation, number of personnel employed, volume of business, sales dollar-per man hour of direct labor, and cost per sq ft or rental of building or floor area.

Mr. Marlette indicated that the results would be broken down according to key geographic trade areas, type of operation, and volume of business. The NAMF offers complimentary copies of the results to survey participants, Marlette said.

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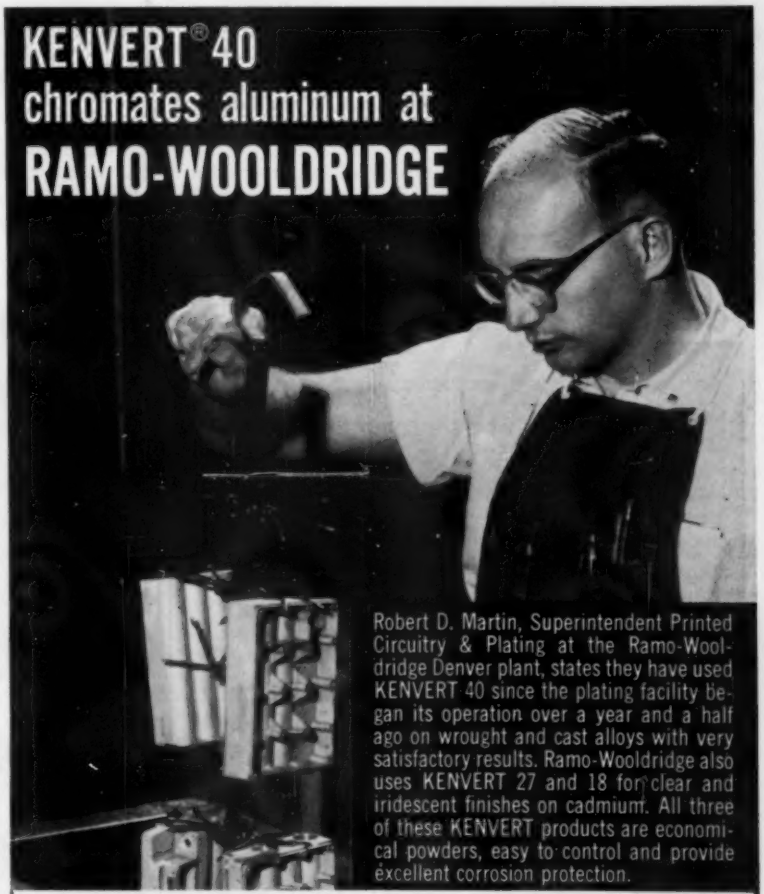

Robert D. Martin, Superintendent Printed Circuitry & Plating at the Ramo-Wooldridge Denver plant, states they have used KENVERT 40 since the plating facility began its operation over a year and a half ago on wrought and cast alloys with very satisfactory results. Ramo-Wooldridge also uses KENVERT 27 and 18 for clear and iridescent finishes on cadmium. All three of these KENVERT products are economical powders, easy to control and provide excellent corrosion protection.

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PATENT ABSTRACTS

(*Continued on page 825*)

2,911,345, 11/3/59—ARTICLE COATING—T. Swenson, assignor to Corning Glass Works, New York.

A type of conveyor for plating small articles is described wherein feed and discharge means are provided and the articles moved through the bath on a spiral fence.

5 claims, figure.

2,911,346, 11/3/59—ELECTROLYTIC TREATMENT OF SLIDE FASTENERS—C. Cohn, assignor to Colonial Alloys, Philadelphia, Pa.

An apparatus for the electrolytic treatment of slide fasteners on a continuous basis is described.

3 claims, figure.

2,911,347, 11/3/59—PLATING RACK—E. Gutzmer, assignor to Intercompany Corp., Chicago, Ill.

A permanent magnet type plating rack is described.

2 claims, figure.

2,912,094, 11/10/59—PLATING APPARATUS—John Davis, assignor to the Udylite Corporation, Detroit, Michigan.

A plating conveyor of the return type is described.

8 claims, figure.

2,912,367, 11/10/59—MEASUREMENT OF CYANIDE CONCENTRATION—E. Asendorf and G. Hullen, assignors to Dugussa, Frankfort, Germany.

An electrometric method for measuring cyanide concentration is described.

13 claims, figure.

2,912,368, 11/10/59—MAKING HOLLOW METAL LASTS—G. Bingham, assignor to Cambridge Rubber Co., Tareytown, Md.

An electroforming method for boot lasts is claimed.

3 claims, figure.

2,912,370, 11/10/59—CADMIUM PLATING—A. Taverna, assignor to Allied Research Products, Inc., Baltimore, Md.

The use of dibutyl naphthalene sulfonate and hydroxyethyl cellulose as a cadmium brightener is described.

18 claims.

2,912,800, 11/17/59—TUMBLING APPARATUS—R. Smith-Gorman, assignor to Rolls-Royce, Ltd., England.

A tumbling apparatus consisting of a plurality of tubes one above the other in a bank is described.

26 claims, figure.

2,912,803, 11/17/59—ABRADING DEVICE—L. Simjian, Greenwich, Conn.

Articles are placed in a flexible container along with abrasive particles, said flexible container is then placed within a partially flexible enclosure which is agitated and caused to move so as to distort the inner container.

See also 2,912,804 (5 claims) by same inventor describing placing a layer of abrasive particles on a surface and polishing by means of sonic energy.

4 claims, figure.

CORRECTION

The patent listed on page 440 in the April issue of PLATING as No. 2,893,927 should have been 2,893,929. The patent is for "Plating Selected Region of n-Type Semiconductors" and is dated July 7, 1959.

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INDUSTRY NEWS

Metal & Thermit Corporation's color "tree" displayed the color and texture versatility of their spray-applied vinyl finishes for steel and aluminum at the product's first public showing at the Design Show in New York, May 23-26.

BELKE APPOINTS GREAT WESTERN CHEMICAL

Appointment of Great Western Chemical Co. as exclusive distributors of Belke Equipment for the eleven western states is announced by Ralph Belke, vice president and sales manager of Belke Manufacturing Co.

Great Western has warehouses at Spokane, Seattle, Portland, Eugene, Richmond and Los Angeles with over 200,000 square feet of warehouse space and 50 trained salesmen covering all types of industry in the eleven western states.

The metal finishing department of Great Western is headed by Harold R. Smallman. The Los Angeles operation is managed by W. A. Nairne. Both these executives were formerly associated with Hanson-Van Winkle-Munning Co. and have had long experience in the metal finishing industry.

♦

McDONALD IS MEXICAN LICENSEE FOR ROTO-FINISH

G. Torres McDonald, Mexican metal finishing engineer and manager of Enthone de Mexico, has entered into an agreement that makes his company exclusive Mexican licensee for Roto-Finish processes and materials, according to an announcement by Roto-Finish Co.

This new arrangement, Mr. McDonald emphasizes, is part of a broad scale program aimed at improving Mexicq's economy by expanding local industry.

UNIT PROCESS ASSEMBLIES IN NEW LOCATION

Unit Process Assemblies, Inc. announces further expansion with their move to a new location which occurred on June 1. The new address is 53-15 37th Avenue, Woodside 77, New York.

Unit Process Assemblies manufactures the Dermitron non-destructive coating thickness tester and periodic-reverse equiment.

♦

KOCOUR REPRESENTS RIEGEL BIAS BUFF

The Bias Buff and Wheel Division of Riegel Textile Corp. has announced the appointment of Kocour Co., 4800 S. St. Louis Ave., Chicago as a representative in the states of Illinois and Wisconsin. The new representative will enable Riegel to service accounts in these two states better than previously.

♦

SEL-REX EXECUTIVE WINS AWARD

G. S. Corigliano, manager, Marketing Division, Sel-Rex Corp., has been voted "Advertising Man of the Year," by the Association of Industrial Advertisers, New Jersey Chapter. An engraved bronze plaque in recognition of the honor was presented to Mr. Corigliano during a dinner-meeting on May 9, held in the Grand Ballroom, Military Park Hotel, Newark, New Jersey.

A graduate of Columbia University, Mr. Corigliano has specialized in industrial marketing activities for over 12 years.

G. S. Corigliano displays "Advertising Man of the Year" bronze plaque awarded him.

Prior to his current position, which he has held for more than five years, he was sales engineer of processing equipment, assistant sales manager, sales-promotion manager, and manager, advertising and sales-promotion, for national companies.

In addition to his activities with the Association of Industrial Advertisers—he is currently senior vice president, New Jersey Chapter—Mr. Corigliano is also a member of the American Marketing Association and the Direct Mail Advertising Association. He has spoken before numerous groups on advertising and marketing subjects and, as staff lecturer, department of marketing, Rutgers University, has taught classes in advertising, sales and sales-promotion, and industrial marketing. Mr. Corigliano also wrote a monthly column—Industrial Marketing Views—for New Jersey Business, official organ of the New Jersey Manufacturers' Association.

Last year, he won the AIA "Best Direct Mail Advertising" award for the Plating Progress campaign which Sel-Rex sends to a list of more than 25,000 executives and technical personnel in the metal finishing and plating industries.

♦

ALLIED CHEMICAL EXPANDING RESEARCH LABORATORY

Allied Chemical has announced a major research expansion which will more than double the laboratory facilities of its General Chemical Division near Morristown, New Jersey. The expansion is another step in Allied's long range development of its Morristown center where the Corporation's Central Research Laboratory is also located.

Construction is expected to be completed in the last quarter of 1961. With this additional space almost 500 research scientists and supporting staffs will eventually be accommodated.

♦

SEYMOUR APPOINTS McKESSON & ROBBINS AS DISTRIBUTOR

The McKesson & Robbins Inc., has been named a distributor for Seymour Manufacturing Co.'s, electroplating additive agents.

The appointment of the distributorship was announced jointly by William P. Haberland, manager of Seymour Manufacturing Co., Electrochemical Division and John E. Zacharias, vice president of the McKesson & Robbins Inc.

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ECONOMY—Plates uniformly over high and low current density areas to save on copper consumption. Easy analysis for brightener level.

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EASY-TO-USE—A single addition agent for rack or barrel plating. Easily controlled for desired brightness level.

HIGHLY ECONOMICAL—Use as semi-bright at half the cost of full bright solutions.

VERSATILE—Easily buffed to cover wheel marks. Also brightens well in areas not easily accessible to buffing. Use in rack or barrel plating operations.

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Produces a very soft plate for quick buffing.

A COMPLETELY ORGANIC SYSTEM—No metallic constituents.

VERY ECONOMICAL—Works well over wide variations of temperatures and concentrations.

EXCELLENT FOR STOP-OFF—Produces plate that resists penetration by heat-treating or case hardening.

VERSATILE—Use in cyanide solutions with or without tartrates, Rochelle salts or proprietary substitutes.

These Isobrite Copper Processes contain no lead and are ready to work as soon as current is turned on, even after week-end shut downs. This means increased production and substantial savings by eliminating poorly plated rejects.

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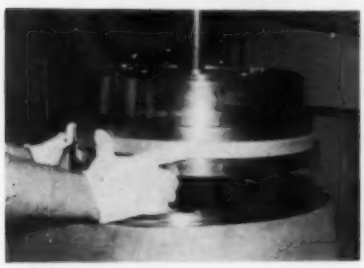
GOLD-PLATED GASKETS GLITTER IN NUCLEAR VALVES

Gold-plated gaskets have been selected for the eight 18-inch tilting-disk check valves being installed at Consolidated Edison Co.'s Indian Point nuclear power station. Research engineers at Edward Valves Inc., Subsidiary of Rockwell Manufacturing Co., determined that the gold plating would be best for the service conditions to be imposed on the valves.

Gold is plated on the pressure-seal gaskets for the valve covers and for the hinge pin covers to withstand the nitric acid that Indian Point designers have determined must be used in decontamination.



Gold-plated gasket being inserted in pressure-seal closure.

The valves will be in primary coolant loops to protect pumps against reverse flow. Operating pressure will be 1500 psi. Operating temperature will be 480F. The coolant is water.

♦

ENTHONE INCREASES NEW YORK STATE WAREHOUSING

Enthone, Inc. of New Haven, Connecticut, has doubled its warehousing facilities in New York State with the establishment of a complete stock of Enthone chemicals at 921 North State Street in Syracuse. This is in addition to the Binghamton warehouse of Austin F. Fletcher, Inc., Enthone distributor.

The Syracuse warehouse will serve the Rochester-Syracuse-Utica area while Austin F. Fletcher, Inc. will continue to serve the Binghamton-Elmira area. Edwin C. Elliott, who recently joined Enthone as sales engineer, will supervise warehousing in Syracuse.

In this manner, Enthone specialty chemicals will be more readily and more economically available to the rapidly expanding metal finishing industry in central New York State. A complete stock of plating supplies and Rohco zinc and cadmium brighteners will also be maintained at both warehouses. Plating equipment and accessories manufactured by Enthone will continue to be shipped from New Haven.

Enthone is a subsidiary of American Smelting and Refining Co.

♦

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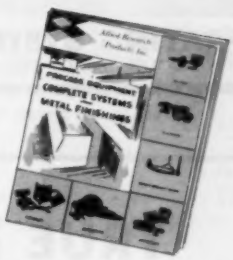

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INDUSTRY NEWS BRIEFS

NICKEL FIGURES RELEASED FOR 1959

Free world mine production of nickel was about 58,000 short tons greater in 1959 than in 1958, according to the Bureau of Mines, United States Department of the Interior. Of the 1959 total, Canada produced about 75 per cent, Cuba 8 per cent, New Caledonia 10 per cent, and the United States 5 per cent.

Total consumption of nickel in the United States was 112,661 short tons in 1959, an increase of 43 per cent over the 1958 figure of 79,017 (revised figure) short tons. Consumption of nickel was up for all uses, with stainless steel, nonferrous alloys, high-temperature and electrical resistance alloys, and catalysts each up between 40 and 50 per cent over 1958. Consumption increase for electroplating was 84 per cent.

♦

TIN BUREAU OFFERS DESCRIPTIVE BOOKLET

"The role of tin in American industry is an important one . . . and will continue to gain in importance as new uses and applications for tin are developed by research." This excerpt appears in a new 20-page booklet now released by the Malayan Tin Bureau.

It contains detailed descriptions of some of the many and varied used of tin in U. S. industry, including tinplate, bronze, white metals, tinning, chemicals, and miscellaneous alloys. Liberally illustrated in three colors, the booklet also contains data on tin mining in Malaya and comprehensive charts on the uses of tin.

Entitled "Straits Tin from Malaya . . . Universal Metal for U. S. Industry," the booklet was prepared by the Malayan Tin Bureau in cooperation with the Tin Industry (Research and Development) Board of the Federation of Malaya and with the assistance of the Tin Research Institute, Inc.

Copies are now available without charge upon request to The Malayan Tin Bureau, Department P, 2000 K Street, N. W., Washington 6, D. C.

♦

BENDIX AVIATION HAS CHANGED ITS NAME

On June 1, 1960, Bendix Aviation Corporation changed its name to The Bendix Corporation. It was reported that the use of "Aviation" in the corporate name was being discontinued because it did not fully describe what Bendix is and does—in electronics, automotive, aviation, nucleonics, missiles and space, computer, machine tool and many other industrial fields.

♦

AMERICAN METAL CLIMAX BUYS PYRON

Acquisition by cash purchase of Pyron Corporation, Niagara Falls, N. Y., by American Metal Climax, Inc. This places American Metal Climax in the unique position of producing both ferrous and non-ferrous metal powders.

Expansion plans include the construction of a new plant in the Niagara Falls area which will double the present output and provide for adequate capacity to meet the growth of the industry. Long range objectives are the research and development of new products through the combined effort of Pyron and AMCO research groups.

♦

PRECIOUS METALS FIRM ACQUIRED BY ELECTRO-TEC

Electro-Tec Corp., South Hackensack, N. J., has announced the acquisition of the business of Lambros Precious Metals Co., New York City.

George J. Pandapas, president of Electro-Tec, said the 25-year-old Lambros organization will be operated through the company's recently-established subsidiary—Precimet Laboratories, Inc. George C. Lambros, former owner of the company bearing his name, has been named president and general manager of Precimet Laboratories.

USE READER SERVICE CARD; INDICATE A 738.

EQUIPMENT AND SUPPLIES

E—701. WASTE ANALYZER—An automatic instrument that can indicate the level of waste impurities in plant discharge as well as in process and drinking water, has been developed by Graver Water Conditioning Co. Currently designed for insolubles in liquids, the instrument has potential for solubles and air sampling. It can have direct application in metal finishing plants and other industrial operations. Among the tests for which it can be used is one for quick cyanide determination. Other applications for the instrument include boiler feedwater monitoring and quality control of products.

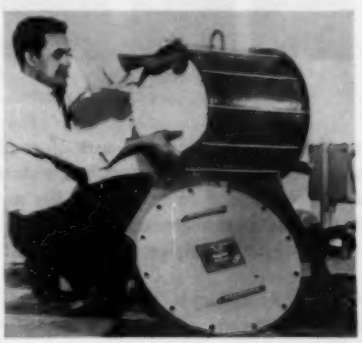
Called the Graver automatic tape analyzer, the device derives its versatility from the basic analyzing method it employes—the Millipore Filter test. The tape analyzer automates the Millipore test by filtering samples in sequence as often as desired through a nylon-backed tape of Millipore Filter membrane and printing the time each sample is taken.

The Millipore tape has an effective porosity of 450 mμ. It filters parts per billion trace solids and shows distinctly on the tape concentrations as low as 2–4 parts per billion.

Operation is entirely automatic. A typical cycle begins when a compartment in the filter head lowers to receive the advancing tape. Then the following sequence takes place: (1) the compartment rises and seals the tape in the filter head; (2) the time is stamped on the tape; (3) the fluid enters the filter head, flows through the Millipore tape and out of the instrument into a calibrated volume measuring tank; (4) the tank is filled to a predetermined volume, setting off an adjustable level switch which moves the inlet valve to the by-pass position and allows the fluid to flow to waste or back into the system; (5) the draining fluid sets off an alarm switch which repositions the inlet valve; (6) the compartment in the filter head lowers again to receive the advancing tape.

E—702. FILTER—An easy-to-maintain filter that opens from the side instead of the top for cleaning and service has been added to the line of metal finishing equipment manufactured by the Udylite Corporation. Mounted on its own base, the filter is a portable unit used to remove solids and chemical contamination from tanks of nickel, copper, cadmium and zinc plating solutions.

The new Udylite Series 60 filter operates at low pressures and low speeds. Hollow filter plates set vertically in the new machine are said to provide greater filtration area to permit operation at lower pressures and speeds with no loss in efficiency.



Depending on the size, the new filters use positive displacement or centrifugal pumps that develop a maximum pressure of 28 psi.

This new filter design provides a minimum of metallic parts in direct contact with plating solutions. There are eight standard sizes of the Series 60 filter, ranging from 200 to 10,000 gal/hr capacity.

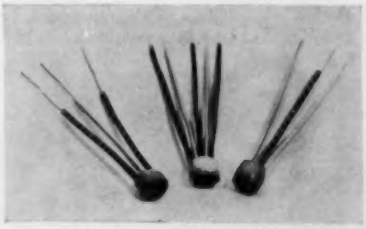
E—703. ABRASIVE DISCS—Clear plastic tubes have replaced chipboard boxes as containers for small abrasive discs made by Behr-Manning Co. a division of Norton Co. The new package is being used for pressure-sensitive adhesive discs up to 2¼ in. in diameter, employed mainly in metal and finishing grinding operations.

The new butyrate holders offer ease of opening and removal; complete protection for unused discs in storage; and dust-proof, moisture-tight packaging which retards drying of the adhesive coating.

E—704. ANODE SCRAP BASKETS—Titanium Products Corp. announces a new and improved line of all-titanium anode scrap baskets in sizes 3 by 12 by 12 in., 3 by 12 by 18 in., and 3 by 12 by 24 in.

These baskets are said to give long life in all acid plating solutions and are now available from stock.

E—705. RECTIFIERS—Radio Receptor Co. (Selenium Division) has developed, subminiature encapsulated rectifiers in center tap, bridge and doubler assemblies. All units are designed for operation in ambient temperatures without derating and are protected against atmospheric conditions by the plastic encapsulation. They will withstand peak surge currents up to 250 mils for one second duration and can be operated in circuits at frequencies up to 25 Kc. All types are color coded for simple identification and polarity indication.



WHY PAY FOR MORE RECTIFIER THAN YOU NEED?

Now, H-VW-M takes the costly confusion out of rectifier design, by reducing *hundreds* of variations — in diodes, protective devices and controls — to *four basic models*, standardized to meet *specific* needs. You save on initial cost *and* on maintenance! Here are the four basic H-VW-M rectifier types, and some of their important features . . .

1. The H-VW-M General Plating Step Control Rectifier

Uses only *one* transformer, not the usual two. Result: high efficiency, lower price. And, H-VW-M has *doubled* the average control accuracy, offering *44 steps* instead of 22.

2. The H-VW-M Barrel Plating Rectifier

This exclusive H-VW-M design uses only the *top-half* of the voltage range — the range you need for higher-voltage barrel processing. You get a high power factor unit with precise 22-step control, and can save as much as 5% on purchase price alone!

3. The H-VW-M Anodizing Rectifier

Automatic surge protection is a *built-in feature* of this specialized design: you can simply set it, and forget it!

4. The H-VW-M General Plating Automatic Stepless Control Rectifier

Unit offers accurate control to 1% of setting. Reliable and sturdy—built to rugged steel-mill requirements for low maintenance costs.

Find out more about all four basic types of H-VW-M *Standardized* Rectifiers, offering many exclusive features and advantages — including complete protection systems. Write today to:

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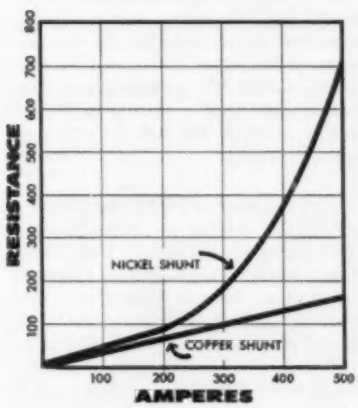
About other H-VW-M electrical equipment

NOW—GENERATOR BRUSH OVERLOAD ELIMINATED

A new H-VW-M Equaload Brush makes overloading impossible. Result: Commutators can now last the life of generators – without resurfacing.

A braided nickel shunt on the new Equaload Brush completely eliminates unequal current distribution because nickel's resistance to current flow increases proportionately with temperature rises. See curve below.



When any brush accepts more than its proportional share of current, the temperature of the shunt rises, its resistance increases and current is immediately distributed equally among the other brushes.

Use of a braided nickel shunt is *exclusive* with H-VW-M. The new H-VW-M Equaload Brush is designed to fit all makes of DC generators.

H-VW-M Form "A" Tank Rheostats – Designed to eliminate all switch failures caused by excessive heating. Standard sizes available with ratings from 30 to 1000 amps. Larger sizes to 5000 amps can be furnished.

H-VW-M Universal Carbon Pile Tank Rheostats – Provide continuous voltage control from fixed plating line voltage source in ranges to 250 amps, 6 to 12 volts.

H-VW-M Motor Generator Sets – Available up to 50,000 amps. Standard voltage ratings are from 6 to 250 volts.

H-VW-M H-VW-M H-VW-M

E—706. FINISHING PROCESSES—Allied Research Products, Inc. has announced the addition of six new finishing processes to its line.

Three of these new formulations are Iridite chromate conversion coatings for providing corrosion protection, paint base preparation and final finishing of nonferrous metals. Two are new brightening addition agents for zinc plating baths. One is a new addition agent for copper plating solutions.

The new Iridites are designated as Nos. 1P, 7P and 11P. All are manufactured in powder form.

No. 1P is a powdered version of the original Iridite No. 1 (olive drab) which was developed in 1943 as a corrosion resistant finish over zinc and cadmium for military use. This material produces a dark green, olive drab film on zinc plate and a similar film, having a brown cast, on cadmium plate.

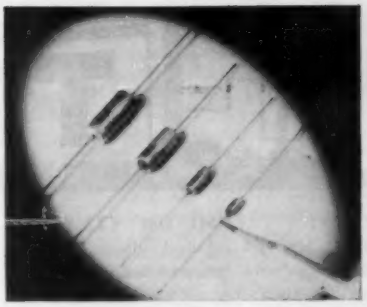
No. 7P is a powdered form of another Iridite originally formulated as a liquid Iridite No. 7, for protective and decorative finishing of cuprous alloys. Unlike its liquid counterpart, this new material, it is claimed, can be used not only to produce high lustre with a chemical polish on cuprous surfaces, but can also be used to provide protection against corrosion and tarnishing ranging from a heavy-duty film to merely a mild passivation.

The third new Iridite formulation is designated as No. 11P. It provides a one-tip, clear, white bright protective and decorative film on zinc plated surfaces.

Both the new Isobrite brighteners, Nos. 333 and 334 are for high current density plating in cyanide zinc solution. Each is said to provide economy of operation, long life, excellent throwing power, a wide current density range and fine-grained, bright deposits.

Isobrite No. 625, with a high tolerance for impurities such as chromium, sulphur, zinc and lead, is lost from the bath only through drag-out or by uniting with impurities.

E—707. SPRAY NOZZLE—Spraying Systems Co. has announced a new spray nozzle, providing a full square spray pattern and extremely wide angle projection. This is the first wide angle spray nozzle developed with a square spray pattern. It is designed for installation on spray manifolds where open area is dimensionally limited. The average spray angle of 110° provides wide coverage within a short distance between spray nozzle and work. The square spray pattern on manifold, multiple nozzle installations, permits keeping spray overlap to a minimum while still providing total coverage.



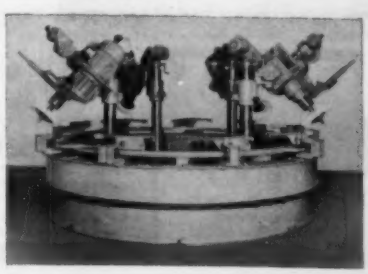
E—708. TANTALUM CAPACITOR—A new series of small solid tantalum capacitors that can operate at full-rated voltage at 85C is now available from Kemet Co., Division of Union Carbide Corp. Known as Series J, the new capacitors occupy about one-third the space of earlier Series H units, yet exhibit the same low leakage current characteristics.

Series J solid tantalum capacitors are available in capacitances ranging from 0.33 to 330 microfarads, and in 6, 10, 25, 35, and 50 volt ratings. The 50-v, 85° capacitor is available in capacitance values up to 22 microfarads, making it the highest rated capacitor of its type commercially available.

E—709. RACK CLEANER—U. S. Industrial Tool and Supply Co. has introduced to the plating field an air tool which was originally designed for riveting. It has been adapted to be used as a fast, easy plating rack cleaner. The tool is light in weight and has an adjustable hammering action, which only occurs when the anvil set touches the metal on the racks. The rapid hammering quickly cleans the racks without damage.

E—710. POLISHING BUFFING—A new Acme automatic polishing and buffing machine that features a rotary conveyor design which cuts floor space requirements for finishing high production parts is now available from Acme Manufacturing Co.

Parts such as automobile moldings, refrigerator trim, stove trim and related types having sweep or angular shapes are ideally adapted to finishing on these rotary conveyor automatic finishing machines. The parts are loaded and unloaded from one position on the periphery of the machine.



TRADE LITERATURE

L—701. ALUMINUM CLEANING PROCESS—A technical bulletin, available from Frederick Gumm Chemical Co., describes their Even-Etch process which cleans wrought or extruded aluminum, removes all micro-corrosion and imparts to the surface a smooth silvery appearance.

The process, which consists of three chemical steps (1) removal of microscopic corrosion, oil and dirt, (2) etching and (3) removal of surface smut, is used before painting, anodizing, spot or inert gas welding.

L—702. ABRASIVE FINISHING—New technical data sheet covering the abrasive finishing of die cast and rolled zinc has been made available by The Lea Manufacturing Co. This information sheet gives such data as polishing wheel speeds, type of buff and recommended abrasive compound. Hand and automatic set-ups using both bar and liquid compounds are covered.

L—703. ANODES AND PLATING CHEMICALS—Hanson-Van Winkle-Munning Co. offers a new bulletin, No. AC-112, describing and illustrating a full line of H-VW-M anodes, anode accessories and chemicals for electroplating and metal-finishing.

Specifications and recommended applications are given for several styles of anode bags, and seven types of anodes. The bulletin lists salts commonly used in electroplating baths and a number of brighteners.

Anodes described include nickel, cadmium, brass and bronze, copper, lead and zinc. Various types of nickel anodes are listed along with recommended applications and *p*H ranges.

L—704. FINISHING MACHINE ADJUSTMENT DEVICE—Packer Machine Co. announces availability of descriptive literature on operation of the Adjusta-Matic, a "packaged" electronic adjustment device, available on all new Packer-Matics units. The company claims the device will reduce wheel wear, achieve more uniform finishes and avoid high compound costs.

The literature, consisting of a 8½ by 11 in. two-color printed sheet, describes the full operation of the device and photographically illustrates wheel or buff compensating motion, vertical and horizontal motion.

L—705. PNEUMATIC INSTRUMENTS—Pneumatic instruments for the process industries are described in a new 12-page Catalog 515, announced by the U. S. Gauge Division of American Machine and Metals, Inc.

Pressure and temperature pilots and pneumatic transmitters are featured in the 2-color catalog. Pilot specifications are listed and control actions are described. Optional indicating controller features are covered, including pneumatic set-point, control by-pass and valve positioner. Pressure and temperature transmitter specifications are also given.

L—706. CHROMIUM REDUCER—A new chromium reducer for use in alkali cleaners and copper plating solutions is fully described in Technical Data Sheet No. 110, a two-page usage and instruction sheet prepared by MacDermid Incorporated. Called Metex Chromium Reducer M-623, the new product is a dry, white granular powder used in soak or electrocleaners and cyanide copper plating solution to reduce hexavalent chromium, and to eliminate adverse effects of this contaminant on subsequent electroplating. Less expensive than sodium hydrosulfite, M-623 also eliminates stains resulting from chrome contaminated cleaners; improves adhesion of the plated coating; extends cleaner life; permits operation of contaminated copper plating bath until time is available for full chromium removal treatment.

L—707. VIBRATION FINISHING—A new 5-page catalog on Vibro-Finishing which has been automated with Vibro-Mation has been announced by Conveyor Corporation. Vibro-Finishing is a new means of applying vibration to the finishing of ferrous as well as non-ferrous parts, which is said to have virtually eliminated several types of finishing processes now in use.

Vibro-Mation is a means of automatically handling both the media and finished parts after they have been processed in the finishing machine. Process includes washing, polishing, cleaning, deburring as required. Storage hoppers or automatic parts feeders can also be furnished for a completely automated system.

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ARTICLE REFERENCES

By
WILLIAM TUCKER
Eastman Kodak
Rochester, N. Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

90. CHROMIUM

a. *CHROMIUM PLATING ON TITANIUM ALLOYS.*
Charles Levy.
Metal Finishing, May 1960, *58*, No. 5, pp. 49–55.

b. *ELECTRODEPOSITION OF HIGH-PURITY CHROMIUM FROM ELECTROLYTES CONTAINING FLUORIDE OR FLUOSILICATE.*
N. Ryan.
Journal of the Electrochemical Society, May 1960, *107*, No. 5, pp. 397–404.

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a. *LINK CLEANING AND DEGREASING TO PRODUCTION MACHINING.*
The Iron Age, May 5, 1960, *185*, No. 18, pp. 84–85.

b. *ULTRASONIC PICKLING CLEANS TURBINE ENGINE PARTS.*
The Iron Age, April 28, 1960, *185*, No. 17, pp. 114–115.

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a. *ACID DIP CONCENTRATION CONTROL—CALCULATION AND ADJUSTMENT OF PERCENT BY VOLUME.*
G. N. Mandel.
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Andrejs Salka.
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a. *STUDIES ON CATHODIC PROTECTION USING THE HULL CELL. 1. ACTION OF CORROSION INHIBITORS.*
K. S. Rajagopalan and Y. V. P. Ramachandra Row.
Journal of the Electrochemical Society, May 1960, *107*, No. 5, pp. 379–382.

b. *EFFECT OF OXYGEN ON THE ACTIVE-PASSIVE BEHAVIOR OF STAINLESS STEEL.*
Norbert D. Greene.
Journal of the Electrochemical Society, May 1960, *107*, No. 5, pp. 457–459.

c. *CORROSION CONTROL APPLICATIONS OF ELECTROLESS PROCESS FOR CHEMICAL NICKEL PLATING.*
Corrosion, April 1960, *16*, No. 4, pp. 23–24.

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HOW TO GET THE MOST FROM SOLVENT-VAPOR DEGREASING—PART II.
T. J. Kearney and C. E. Kircher.
Metal Progress, May 1960, *77*, No. 5, pp. 93–96, 162–164.

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WHY HONING?
M. M. Patterson.
Part III—Grinding and Finishing, April 1960, *6*, No. 4, pp. 42–45 and Part IV—May 1960, *6*, No. 5, pp. 44–46.

96. MISCELLANEOUS

a. *HOT-DIPPED METALLIC COATINGS.*
John H. Nicholls.
Corrosion Technology, April 1960, *7*, No. 4, pp. 107–110, 117.

b. *MEASURING PLATING LOADS FOR ROUND HEAD STEEL SCREWS.*
George Clayton Field.
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97. ORGANIC

a. *A MORE VERSATILE SOURCE OF INFRARED HEAT.*
W. H. Tomb.
Products Finishing, May 1960, pp. 66–70, 74–78.

b. *LACQUERING TECHNIQUES FOR VACUUM METALIZING ON METALS AND THERMOSETTING PLASTICS.*
M. A. Self.
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c. *SPRAY-APPLIED DECORATIVE DISPERSION COATINGS FOR METAL PRODUCTS.*
Harold Preuss.
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d. *POLYESTER-GLASS COATING RESISTS CORROSION INSIDE METAL TANK.*
The Iron Age, May 5, 1960, *185*, No. 18, pp. 76–77.

98. TESTING

EUROPEAN PAINT-HARDNESS TESTERS VERSUS THE SWARD ROCKER.
Marcel Dierckx.
Products Finishing, May 1960, pp. 52–55, 58–64.

The following are Metallurgical Abstracts taken from The Journal of the Institute of Metals:

December 1959, pp. 257–259.

Comparison of the Corrosion-Resistance of Zinc, Cadmium and Tin Coatings on Steel. H. W. Dettner (Werkstoffe u. Korrosion, 1959, 10, (5), 321–326).

Electrophoresis: A New Coating Tool. Robert A. Keeler and Louis C. Terminello (Amer. Machinist, 1959, 103, (10), 138–139).

New Investigation in the Field of Vapour-Phase Inhibitors. Leo Cavallaro and Giorgio Mantovani (Werkstoffe u. Korrosion, 1959, 10, (7), 422–425)—Corrosion tests on grey Fe are described using 100 per cent relative humidity at 35C and in the presence of dicyclohexyl-ammonium nitrite, octadecylamine, Na benzoate, morphalin, and acetylamine, as vapour phase inhibitors, the last two being the most effective. Using the inhibitors on wrapping paper improves protection. The amount of inhibitor deposited on various surfaces at different temp. is tabulated, and positions and distances of inhibitors from the metal is discussed.

Electrodeposition of Titanium from Aqueous Hexafluorotitanate Solutions. Susumu Morioka and Akimi Umezono (Nippon Kinzoku Gakkai-Si., 1959, 23, (1), 71–74).—(In Japanese). The electrodepn. of Ti from an aq. soln. of $(NH_4)_2TiF_6$ contg. 0.25–250 g/l. at 20C and various c.d. on to Ti, Pt, Cu, Zn, and Al showed that the reduction of the Ti^{4+} ions begins at a c.d. of 80 μ amp/cm^2 in a soln. of pH $\sim$ 3 at 0.8V. Visible deposition of Ti occurs between -1.1 to -1.2V. The simultaneous evolution of H during deposition throws doubt on the theory of reduction by nascent H.

The Effect of Surface-Active Substances on the Crystal Shape and the Texture of Zinc Electrodeposits. K. M. Gorbunova and K. P. Lebedeva (Zhur. Fiz. Khim., 1959, 33, (3), 669–676)—(In Russian).

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Internal Stresses in Electrodeposited Copper. Yu. V. Lyzlov and A. G. Samartsev (Zhur. Fiz. Khim., 1959, 33, (6), 1345–1352)—(In Russian). Internal stress (s) in Cu deposited from acid soln., with and without thiocarbamide and gelatine, was studied by the contractometer method at various c.d. and temp. In all cases the abs. value of s increases with increase in thickness of the deposit. In the absence of addn. agents, s is tensile and increases with c.d., decreases with temp., and varies according to the concn. of impurities in soln. Addn. of thiocarbamide and gelatine causes immediate formation of compressive s which either passes through a max. and then changes sign with increase of thickness of the deposit, or increases indefinitely with increase of thickness. This can be caused by the changes of lattice spacing, the nature of which varies with time of deposition and thus with thickness of the deposit. The alteration of the rate of removal of addn. agents from soln. causes the phenomenon of levelling.

Corrosion
National Association of Corrosion Engineers
1061 M & M Bldg.
No. 1 Main St.
Houston 2, Texas

Corrosion Technology
Leonard Hill Technical Group
Stratford House
9 Eden St.
London, N.W. 1
England

Grinding and Finishing
Hitchcock Publications
Wheaton, Illinois

The Iron Age
Chestnut and 56th Streets
Philadelphia 39, Pa.

J. Electrochemical Society
1860 Broadway
New York 23, N. Y.

Metal Finishing
381 Broadway
Westwood, N. J.

Metal Progress
American Society for Metals
Metals Park
Novelty, Ohio

Products Finishing
431 Main St
Cincinneti, Ohio

PERSONALS

SANTO PONTICELLO has been appointed to the home office sales and engineering staff of Davies Supply and Manufacturing Co., St. Louis.

Mr. Ponticello recently completed a six-month training course with Davies and The Udylite Corp., which Davies represents in a nine-state area. He attended Syracuse University and is a mechanical engineering graduate of the University of Michigan. During three years in the Navy, he served as Engineering Officer.

S. Ponticello

W. P. Alina

WALTER P. ALINA, plating engineer in the production engineering department of the Somerville, N. J. plant of RCA, has received the top award of a transistor radio for establishing the best record of cost reduction of all of the departments in the plant over a half-year period. Although Mr. Alina only joined RCA late in 1958, this is his second award for showing greater savings in the plating department than any of the nearly 15 departments. He is a member of the AES Newark Branch.

♦

SAMUEL WEIN has been appointed consultant in the field of electroless plating and printed circuitry for MacDermid Incorporated.

Mr. Wein, long eminent in this field, is perhaps best known for pioneering the photo-electric effects of the metals, and rectification of ac to dc of the metals and corresponding sulphides. Mr. Wein is accredited with more than one hundred patents.

As early as 1914, Mr. Wein demonstrated the principles of television, and in 1915 demonstrated sound on film, using selenium light sensitive cells in both cases —contributing, no doubt, to his nickname of "Selenium Sam." He has authored numerous articles, scientific papers and other technical literature, notable among which are "Metalizing Non-Conductors" and "Metallic Coatings on Non-Metallic Materials."

S. Wein

G. M. Herring

GLENN M. HERRING has been appointed assistant to the vice president—sales of Hanson-Van Winkle-Munning Co.

In his new capacity, Mr. Herring will assist in general sales management under R. M. Norton, vice president—sales. He will continue in the management of the Eastern Sales District, with headquarters at Matawan.

PLATING MAGAZINE

OPPORTUNITY TO AUTHORS

Member or non-member authors of technical and scientific papers on electroplating, metal finishing and allied arts are cordially invited to submit manuscripts of original, unpublished papers to the Editor of PLATING MAGAZINE for review and publishing consideration.

Any such paper accepted and published in PLATING will also be eligible for selection by the Society's Paper Awards Committee for the Carl E. Heussner AES Gold Medal Award; AES Silver Medal; AES Bronze Medal; George B. Hogaboom Memorial Nickel Plating Award; Robert S. Leather Mechanical Finishing Award; Chromium Plating Award; Precious Metal Plating Award of AES, or the John J. Hanney Memorial Copper Plating Award.

So as to expedite review and other processing, please write the Editor, PLATING MAGAZINE, 443-445 Broad Street, Newark 2, New Jersey, for full particulars, including a copy of "Publishing Specifications for PLATING MAGAZINE Authors", before submitting your manuscript.

Mr. Herring joined the H-VW-M in 1930 as a sales trainee. He was appointed sales representative to the Pittsburgh area upon completion of this course. In 1955 he transferred to the home office in Matawan and was appointed manager of steel mill sales. Three years later, 1958, he was appointed to the post of district manager—Eastern states (New Hampshire to Florida).

He is a graduate of Lafayette College where he received his BS in 1930. He is an active member of the American Electroplaters' Society, Association of Iron and Steel Engineers and the University Club of Pittsburgh, Pennsylvania.

♦

SAM S. COMO has been appointed assistant sales manager at Unit Process Assemblies, Inc.

Mr. Como will be concerned with the sales administration of the company's Dermitron coating thickness tester and periodic reverse equipment.

He has a background of study of electrical engineering at the Cooper Union Institute of Technology.

S. S. Como

H. L. Ferguson

H. LESLIE FERGUSON has joined Sel-Rex Corp. as resident service engineer for the New England states. Mr. Ferguson was with Technic, Inc. for the past six years.

A chemistry major at Bowdoin College, he was a science teacher early in his career. Self-employed as a plating consultant to the jewelry manufacturing industry for over five years, he is considered to be an authority on the solution of problems connected with precious metals electroplating. In addition to his consulting work, Mr. Ferguson also gained first-hand knowledge of jewelry manufacturing as plating foreman with Anson Incorporated and Coro Inc.

He has been an active member of the American Electroplaters' Society for over 15 years, and served as president of the Providence-Attleboro Branch during 1958–1960. He is also credited with being one of the originators of the Jewelry Industry Seminar sponsored by that Branch.

As soon as he has completed an intensive indoctrination period at Sel-Rex's Nutley, New Jersey laboratories, Mr. Ferguson will make his headquarters at the firm's New England offices located at 915 Industrial Bank Building, Providence, Rhode Island.

RONALD E. CUNNINGHAM has been appointed director of sales for Anadite, Inc. Credited for developing many new color anodizing techniques for aircraft interiors and electronic components, he was for the past three years Anadite's assistant director of sales and special coordinator for research and development.

R. E. Cunningham

Dr. C. A. Snavely

DR. CLOYD A. SNAVELY has joined Sifco Metachemical, Inc., as general manager. A native of Massillon, Ohio, Dr. Snavely is a graduate of Columbia University where, in addition to an AB degree, he received his BS and MS degrees in metallurgical engineering.

Following four years' service in the U. S. Navy, which he left as a Lieutenant-Commander, Dr. Snavely joined the Battelle Memorial Institute, Columbus, in 1946. For the past six years he has been assistant manager of the chemical engineering department of the Institute. A specialist in electrochemistry, Dr. Snavely received his PhD in metallurgy in 1947 from Ohio State University.

♦

JOSEPH M. ASHMORE JR. has joined Tumb-L-Matic, Inc. manufacturers of barrel finishing equipment and com-

21 million spoons and 20 years ago...

... Reed and Barton, one of the country's leading silversmiths, installed their first Packer-Matic automatic polishing and buffing unit in 1939. 7 additional Packer-Matics were purchased as the years went by, production requirements rose and the first Packer-Matic proved itself.

"We haven't had a nickel's worth of trouble with any of our Packer-Matics, reports Mr. Henry C. Gill, Jr., Reed and Barton's Assistant Production Manager. The Packer people build them to work ... right ... and all the time."

The Model 5 double roll unit shown in the photograph went into service on May 24, 1939 and has been used for a variety of cut and color operations on the fronts and backs of flatware handles, spoon bowls and fork tines. Versatility is a must!

If you are in the silverware or flatware business, we can help. As a matter of fact, we can help you on any polishing, buffing, cleaning or deburring problem, whatever your line. Why not send samples along with your specifications or prints and let us show you.

Production reliability makes Packer-Matic the choice of companies like

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pounds at St. Mary's Street, Stamford. Mr. Ashmore has been named vice president in charge of purchasing.

He is a native of Williamstown, N. J. and a graduate of Temple University, Philadelphia, Pa. where he received an Associate in Science degree. He also studied at LaSalle College, Philadelphia, Pa., for a two year period majoring in electronics.

Mr. Ashmore was formerly a research technician with the S.K.F. Industries, Inc., Philadelphia.

♦

R. F. PROTIVA has been named manager of the Cleveland plant of Heil Process Equipment Corp., in charge of all manufacturing, estimating and product promotion of the company's line of chemical resistant process equipment.

He joined Heil Process as sales engineer in 1940 following his graduation from Case Institute of Technology with a degree in metallurgical engineering. He became manager of process industry sales in 1956, Eastern sales manager in 1957 and manager of market development in 1959.

R. F. Protiva

G. R. Kastler

GORDON R. KASTLER has been promoted to manager of the Salt Lake City, Utah, branch of the L. H. Butcher Co., subsidiary of the Udylite Corp.

Mr. Kastler had been assistant manager of the branch for the past six years. He attended Eagle Grove Junior College in Eagle Grove, Iowa, and served in the Southwest Pacific with the U.S. Army Intelligence Corps during World War II.

♦

JAMES F. ZIEVERS of La Grange, Illinois, was recently elected president of the Foreign Sales Division, Inc., of Industrial Filter & Pump Mfg. Co., Cicero, Illinois, by the board of directors of the parent company.

Mr. Zievers is vice president and general sales manager of Industrial Filter & Pump, and has served in various sales and executive capacities during the past ten years with the company.

Mr. Zievers is a graduate of Kings Point Merchant Marine Academy, Ripon College and Northwestern University and holds a Master of Arts degree from the latter. He is a member of the American Society of Chemical Engineers, American Economic Association, American Statistical Society, Western Society of Engineers and International Society of Cane Sugar Technologists.

J. F. Zievers

E. C. Elliott

EDWIN C. ELLIOTT has joined Enthone, Inc. of New Haven, Connecticut, subsidiary of American Smelting and Refining Co., as a sales engineer. He will represent Enthone in the Rochester-Syracuse-Utica area of central New York State.

Mr. Elliott has studied at Union College and the University of Rochester. He has had over 20 years' experience in metal finishing as plating chemist, plating foreman and, most recently, as a senior sales engineer for Frederic B. Stevens, Inc. He is a vice president of the Syracuse Branch of the American Electroplaters' Society.

♦

LEO C. DAMSKEY has been promoted to sales manager, Midwest District, for Amchem Products, Inc., Metalworking Chemicals Division. Mr. Damskey will make his headquarters at the district sales office, in Detroit, Michigan.

At the same time, **ORAN E. CRISLER** was promoted from staff assistant to the newly created position of assistant sales manager, Midwest District, and **KEN C. KRAMER** was also promoted to sales supervisor in the district formerly supervised by Mr. Damskey.

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A comparison showing the superiority of Kelite Anodyne HD over a typical anodic steel electrocleaner.

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For further information or a Product Bulletin, contact the nearest Kelite office listed below.

KELITE CORPORATION

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BRANCH NEWS

Total AES Branches U. S., Canada, Australia, July 1, 1960—58.

BLUE RIDGE

Korbelak Presents Paper on Gold Plating

The regular meeting was held May 6 in the Coach Room of the 52 Diner in Winston-Salem, N. C. Branch President **Nelson Murphy** presided over the business meeting. Twenty-five members and guests were present.

The election of officers for 1960–1961 was held. Those elected were: **Bruce Wallace,** president; **Carl Witherspoon,** first vice president; **Grover Galloway,** second vice president; **Donald McGee,** secretary-treasurer; **Fred Ploszay,** librarian. An election was also held to select the board of managers. Those elected were: **Mike Milo,** Dr. Nelson Murphy and **T. R. Boggess.**

The membership decided to hold the next meeting in Blacksburg, Virginia as a family picnic. This meeting will be held on the campus of Virginia Polytechnic Institute. Present plans call for a tour of the physics department for the men and a tour of the home economics department for the women. The members hope that this picnic will be an annual affair.

After the business meeting **Bob Probert** introduced the speaker for the evening, **Al Korbelak** of Sel-Rex Corp., Nutley, N. J. Mr. Korbelak spoke on "Gold Plating." A brief history of precious metals plating was given. The main part of the talk covered the methods, uses and properties of gold plating.

Donald H. McGee
Secretary

BOSTON

Le Moine Talks About Spray Painting on Snowy Night

It snowed and snowed and snowed, but Boston Branch held a meeting just the same on March 3 at the Statler Hilton with second Vice President **George Marotta** in charge.

Communications were read concerning the Waterbury newspaper reprint on plating, Springfield turkey shoot, New England Metallurgical Instrument Clinic, Providence-Attleboro spring meeting, and Rochester proclamation concerning **Mr. Beuckman** as a candidate for National Third Vice President. **Manson Glover** reported on the Interim Meeting, George Marotta on the Annual Meeting progress, and **Jack Wright** moved that the speaker be invited to speak again next year—but not in February or March.

Bob Pierce presented **Robert LeMoine** of the Gray Co., who spoke on airless spray painting. He discussed the complete elimination of over-spray and either the complete elimination of a water wash spray or, if at all, an absolute minimum. Spray painting was shown to be possible for plant maintenance while regular work was in progress, even in a brewery on a pasteurizing machine while packaging was going on. He showed a color film demonstrating the exact steps and equipment, as well as how excellent coverage was obtained without unnecessary overspray and drips. The meeting adjourned at 9:15 p.m. with a hearty request that the speaker be sure to return next season. Eighteen were present.

George P. Swift
Secretary

BOSTON

Bikales Discusses Duplex Chromium Plating

Boston Branch met Thursday, April 7 at the Hotel Statler-Hilton with President **Hugh Foley** in charge.

Communications read concerning delegates at California, increase in Research Memberships and the Hartford Regional meeting. Three applications for membership were processed. **George Marotta** discussed the possibility of a joint cocktail party at the September Annual. **Lou Gagnon** reported on the possible outing at Plymouth for the 1961 Convention. Discussion of newspaper publicity on monthly meetings lead to the suggestion that the financial editor would be a likely recipient for notices. The Rochester proposal of **Frank Beuckman** for third vice president was read and on motion of **Manson Glover** it was voted that delegates go uninstructed on the matter of a third vice president.

Bob Pierce presented **Richard Bikales** of Metal & Thermit who spoke on Duplex Chromium Plating, in place of **Mike Shacat** who had just returned from an operational visit to the hospital. Dick discussed the latest developments in chromium plating and illustrated the talk with slides. The various types of plating baths were mentioned along with the corrosion data to show actual figures of what could be expected.

George P. Swift
Secretary

BRITISH COLUMBIA

Nichols Discusses AES Affairs

A general meeting was held on Tuesday, May 3, at the Lougheed Hotel, North Burnaby. Following cocktails and dinner, the meeting opened with President **Nelson Shepherd** in the chair, who welcomed guests and members.

An application for membership was received and accepted.

N. Shepherd introduced the speaker, **John P. Nichols,** National Executive Secretary of the American Electroplaters' Society.

Mr. Nichols gave an outline of regional grouping of Branches throughout the USA and Canada; gave us an up-to-the-minute report on the forthcoming convention to be held in Los Angeles this summer; and paid tribute to our Branch members, **W. Kellerman** and **G. Smith,** for their efforts on behalf of the Night School Electroplating course.

The President thanked Mr. Nichols for his informative address.

The meeting was then turned over to **W. Marquardt** to act as moderator during the question and answer period. The various members of the Branch asked the questions and Mr. Nichols provided the answers. Mr. Shepherd thanked Mr. Nichols on behalf of the Vancouver Branch.

BUFFALO

Wesley Speaks on AES and Installs Officers; Branch To Bid For 1966 Convention

The Buffalo Branch held its final meeting of the 1959–60 season Friday, May 6 at the Niagara Manor, Buffalo, N. Y. with a total of 30 members and visitors in attendance.

One new member and one transfer were welcomed.

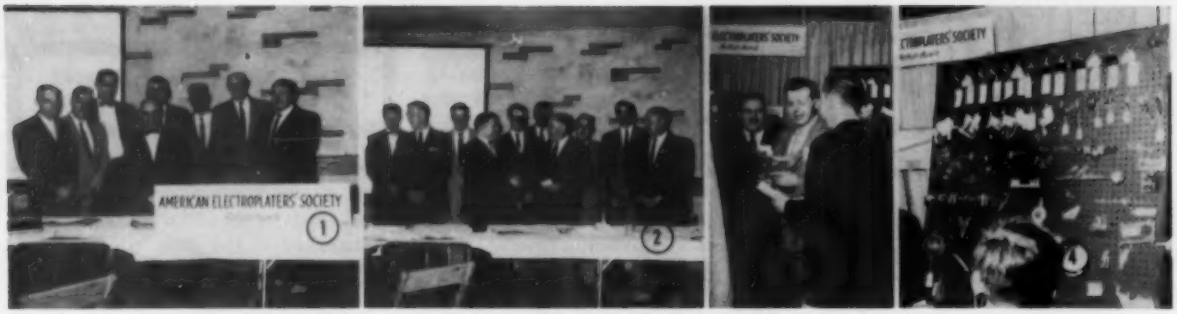
Harold Shapiro and **George Wolf** reported on the success of the Technical Societies Fair held in Buffalo Memorial Auditorium at which the Branch sponsored a booth. A potential of ten new members resulted from the exhibit.

Ray Kilroy gave a favorable report on sickness. **Leon Nowak** and **Ralph Stemmerich** who have been on the sick list were in attendance.

Rolland Campbell reported on the Regional Board Meeting held in Elmira, N. Y., April 30, and was then elected as the carryover delegate to the 1961 meeting in Rochester, N. Y.

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.



BUFFALO BRANCH OFFICERS INSTALLATION AND BRANCH FAIR DISPLAY

(1) Past Presidents of AES Buffalo Branch. Left to right, Frank Rudolph, Rolland Campbell, Fred Goeckel, James Monneypenny, C. J. "Doc" Wernlund, Joseph Ruff, Bert Kirchoff, Anthony Nigro (in front). Absent, Ralph T. Mead and Allen A. Janis. (2) Newly installed Branch officers for 1960-1961. National First Vice President W. Andrew Wesley (center, right) congratulates Branch President Harold Shapiro. Left to right, John Donaldson, first vice president; Robert E. Lienert, third vice president; Robert C. Eich, secretary; Mr. Shapiro; John Tiebor, librarian; Raymond E. Blechinger, sergeant-at-arms; Dr. Wesley; Rolland E. Campbell, John C. Scholterer and Bert Kirchoff, board of managers. Officers not present: Roger Brown, treasurer; Richard L. Davis, second vice president. (3) At the Buffalo Branch booth at the Technical Societies Fair—Branch President Shapiro and Dan Stachowiak. (4) Electroplating display at the Buffalo Branch booth.

Chuck Fotheringham presented a dynamic talk on what the City of Buffalo can offer in bidding for the 1966 Convention. The Convention Bureau is prepared to give the Branch their full co-operation in securing and planning a Convention.

Mrs. Joan Wiarda was elected to replace **John Donaldson** as an alternate delegate to the Convention.

President Campbell introduced the guest of the evening, **Dr. W. Andrew Wesley,** National first vice president, who reviewed the structure, objectives and accomplishments of the Society.

Following his talk, Dr. Wesley installed the officers for the 1960–61 season and then turned the meeting over to Harold Shapiro, newly installed President.

A rising vote of thanks was given to Rolland Campbell, the retiring president.

President Harold Shapiro presented pins to the following past presidents: Joe Ruff, 1938–45; Doc Wernlund, 1948–49; Bert Kirchoff, 1949–51; Tony Nigro, 1951–53; Jim Moneypenny, 1953–55; Doc Janis, 1955–56; Ralph Mead, 1956–57; Fred Goeckel, 1957–58; Frank Rudolph, 1958–59; Rolland Campbell, 1959–60; Charley Logan, 1945–47 and Siebert Johnson, 1947–48 are both deceased.

Robert E. Lienert
Secretary

CHICAGO

Ladies Nite
Ranks with the Best

The Chicago Branch held its annual Ladies Nite at the Austin Fine Arts Club, 808 North Parkside Avenue, on Saturday evening, May 7. The social hour began

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at 6:30 p.m. and a buffet dinner was served in a very congenial and attractive club dining room. The food was excellent and many partook of second helpings—well, there go the diets, folks!

The program was a sound and color movie of a trip taken by Mr. and Mrs. **Carmie Crawford** called "Around the World in 79 Days." The photography, musical sound-track, editing and narration all done by Mr. Crawford was indeed—terrific! The movie was very interesting and highly entertaining.

The door prizes furnished by the Branch were won by the following women: Dorothy Stanek (clock); Gertrude Waage (rose pin); F. Berquist (pearls); Shirley McDonald (broach) and Ruth Dunning (earrings).

Ladies Nite turned out to be a very enjoyable and entertaining evening.

Christopher Marzano
Publicity Chairman

CINCINNATI
Host to Tri-State Regional Meeting

The Cincinnati Branch hosted the Sixth Annual Tri-State Regional Meeting on Saturday, April 23.

Between 150 and 200 people attended the Educational Sessions which consisted of five papers aimed to cover a wide range of topics which would appeal to personnel in many phases of the finishing industry. **Ralph (Duke) Wysong,** Studebaker-Packard Corp., president of the National Society, was the Honorary Chairman for the educational phase of the program. **Robert Giesel,** president of the Adolph Plating Company, discussed the method of testing used by his company for personnel selection and presented examples of some of the tests used. **James D. Thomas,** General Motors Research Corp., discussed the research programs of the SAE, ASTM and AES as they affect the metal finishing industry. **George Barnes** and **Leon Weinberger** of Case Institute of Technology discussed waste disposal problems and some examples of what the plater can do to help himself. **John Harper,** Harper Buffing Machine Company, discussed a new approach to metal finishing, "The Harperizer." **Dr. Abner Brenner,** National Bureau of Standards, discussed his 1958 trip to Moscow. His talk was augmented with stereo slides of some of the highlights of his visit.

Five hundred forty-one people turned out for the evening's festivities which included a cocktail hour, sponsored by many of the suppliers to the industry, a banquet and dance. There were some lucky people who went home with some very nice door prizes, and it appeared that everyone had a good time.

The following is a list of the chairmen who arranged the festivities: General Chairman, **Lee Howald;** educational, **Dave Kaplan;** publicity, **Gerry Poll;** hotel and registration, **Ed Roof;** tickets, **Dick Evans;** treasurer, **Gordon Speers;** ladies program, **Mrs. Virginia Stephenson;** entertainment, **Frank Miller;** banquet, **Roger Winterman;** and program, **Carl Truman.**

David L. Kaplan
Secretary

CINCINNATI
Wagner Talks on Duplex Chromium Plating

Forty-four members and guests met at the Engineering Society to hear **Karl Wagner** of Metal and Thermit discuss Duplex Chromium Plating. Mr. Wagner discussed some of the corrosion resistance data which have been compiled, showing the ability of the duplex chromium plate to increase corrosion resistance. This better resistance is accomplished by first plating a layer of crack-free chromium and then a layer of finely cracked chromium. Mr. Wagner explained the theory behind the process and augmented his discussion with slides.

Mr. Stephenson appointed **Chuck Wise** and **Dick Evans** as the auditing committee and **Carl Truman** as the new representative to the Tri-State Committee

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TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	5/16-1/2

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INCORPORATED

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The results of the annual elections are as follows: President: **Earl Leonhardt,** First Vice President: **Gerard Poll Jr.,** Second Vice President: **Charles Dumont,** Librarian: **Robert Winston,** Secretary: **David Kaplan,** Treasurer: **Gordon Speers.**

The group adjourned to the social hour sponsored by Metal & Thermit, with **Elmer Rehme** as host.

David L. Kaplan
Secretary

COLUMBUS

New Officers Installed At Annual Banquet

The annual May banquet was held on Thursday, May 5, at Presutti's Villa with 45 members and guests present. Dinner was followed by a short business meeting at which 1960–61 Branch Officers were installed, and one new applicant was elected to membership.

Guest speaker of the evening, **George Finneran** of Weeks-Finneran Insurance Agency, Columbus, Ohio, presented a hilarious talk on "How to Resist Salesmen."

L. D. McGraw
Secretary

DALLAS-FORT WORTH

Beckwith Speaks on Duplex Nickel Plating

The regular meeting of the Dallas-Fort Worth Branch was held on Wednesday, May 18 at Howard Johnsons' Turnpike Restaurant with 41 members and guests in attendance. After the social hour and fine dinner, President **Myron Browning** called the meeting to order. The first order of business was the introduction of the guests who were: **Harry Narco; Harold Cox** of Chance Vought, **Grady Roswell, Jack Little** and **Marvin Howath** of Convair, **Charles Mowles, Leonard Dennison, Jim Cammeron** and **Ray Patterson** of Teer Plating, and **Al Jocis** of MacDermid, Inc. A motion was made and carried that the delegates to the National Convention were to have a free hand in their voting. **Fred Howard** then gave a report on the progress of the formation of the Bylaws for the Branch. **Doug Cox** reported on the tentative schedule for the fall meetings, and asked for suggestions for speakers. **R. H. Heppel** asked for blooddoners for **Roy Thomas,** who is in the hospital. The secretary told the group that 16 members from the local Branch were going to be in attendance at the National Convention. The drawing for the evening's door prizes was conducted by **Ray Rinehart,** and **F. E. Lane** and **Don Allie** were the lucky winners.

Myron Browning introduced the speaker of the evening, **Dr. M. M. Beckwith** of Harshaw Chemical who presented a very enlightening talk on Studies in Duplex Nickel Plating. The talk was of the progress being made in the automotive industry in combating the corrosion problems that are encountered on steel and die cast parts. The talk was augmented with slides showing cross sections of duplex nickel coatings compared with the conventional coatings being used. A question period followed with these members asking questions: Doug Cox, **Bill Teer,** Al Jocis, **Bubby Lane,** R. H. Heppel, **Tom Foy, John Lane,** Ray Rinehart and **Joe Fazi.**

T. E. Betz
Recording Secretary

DAYTON

Jackson Discusses Zinc and Cadmium Solutions

The annual business meeting was held as a dinner meeting at the Yum Yum Inn on May 18. The officers elected for the coming year are: President, **Byron A. Bowman;** First Vice President, **Lawrence J Hadlock;** Second Vice President, **Robert D. Fisher;** Secretary, **Duane Prosser;** Treasurer, **A. W. Wendt;** Librarian, **Walter Anderson.**

The retiring Secretary, **Richard Clinehens,** reported that on May 1, 1959 the Branch had 123 members but on May 1, 1960 there were only 104, a decline of 19. He explained that 9 new members had been elected, 2 had transferred into the Branch, 4 had transferred out, 4 had resigned, and 20 had been suspended. The average attendance at meeting during the '58–'59 season was 36 and during the '59–'60 season it was 38. Dick also pointed out that 38 per cent of the annual dues of each member, which is retained by the Branch, was spent in sending out meeting notices. If this had been done by an outside service, this amount would have been doubled. The Branch gave Dick a rising vote of thanks for his long and generous service to the Branch.

Larry Hadlock announced that tickets are available for the next meeting on June 4 at the Delco Lodge. This will be a mixed Las Vegas party accompanied by a picnic lunch, refreshments and prizes.

The speaker of the evening was **Joseph L. Jackson,** technical service director, R. O. Hull & Co., Inc., Rocky River, Ohio. Mr. Jackson discussed the various factors affecting the efficiency of zinc and cadmium solutions and related them to practical plating problems. He showed that, particularly with zinc, higher efficiency could be obtained by increasing the metal content, the caustic content, and the temperature and by lowering the cyanide content. Lowering the metal, caustic or temperature and increasing the cyanide will result in lower efficiency.

The meeting concluded with refreshments courtesy of the Branch.

L. A. Critchfield
Publicity Committee

DENVER

Plant Tour and Election of Officers

The Denver Branch met May 13 for a social night with wives and friends at the Coors Brewing Company in Golden, Colorado. During the short business meeting the slate of officers nominated at the April meeting were officially elected to serve the 1960–1961 years. The group was conducted on a tour of the brewery and then shown a film on sports in Colorado. Following the film refreshments were served. A good time was had by all.

Elmer A. Schuster
Secretary

HARTFORD

Logozzo Installs New Officers; Gilbert Speaks on Vacuum Coatings

The regular Branch meeting was held at the Veterans of Foreign Wars building in Elmwood on April 18 and 46 members and guests were present. Preceding the meeting a colored movie entitled "Precious Metals" was shown. Mr. Logozzo then installed the following new slate of officers:

Walter Dyber, president; **Stanley Grabowski,** first vice president; **Edwin Crandall,** second vice president; **Stanley Platoz,** secretary; **Armand Roy,** treasurer; **Arthur Logozzo,** educational advisor; **Ruel Katz,** chairman, **John Zapatka** and **Robert Tiers,** educational committee; **Robert Michaud, Arnold Johnson** and **Joseph Loersch,** board of managers.

The guest speaker for the evening was **Morton B. Gilbert** of F. J. Stokes Corp. whose subject was "New Developments in the Deposition of Heavy Vacuum Metalized Coatings." Decorative and functional vacuum coatings were described. Method involves the evaporation or sublimation of the metal under a vacuum and condensing it on other materials. May be deposited on plastics, metals, glass, etc. for decorative purposes and of various thickness for functional use, at the rate of 0.1 of a mil in 10 minutes. Cadmium, zinc and aluminum have been deposited in this way to avoid hydrogen embrittlement. Very clean surfaces are required for good adhesion.

The technical chairman for the evening was **Harry Sanders.**

Stanley Platoz
Secretary

HARTFORD

Plant Tour Winds Up Season

The final Branch meeting of the season was a tour of the metal finishing facilities at the Royal McBee typewriter plant located in Hartford. Preceding the tour 66 members and guests had dinner at the Royal McBee cafeteria.

Plant guides took the various groups through the plant and the following metal finishing operations were seen in operation: Conveyorized copper, nickel and chromium plating set-up, a small set-up for producing satin chromium finish, barrel chromium plating for small parts, several barrel nickel plating baths with reclaim tanks for recovering nickel salts, conveyorized zinc cycle with a step for blackening the zinc. A tank lay out was shown where various other metals such as tin, cadmium, etc. were plated.

Also seen was the buffing department, in operation a tank for producing a black on steel parts, the tumbling department showing the various types and sizes of barrels required to produce the necessary finishes needed, also shown in operation was a vibratory type barrel or deburring machine claimed to have eliminated several conventional rolling barrels. Also shown was a conveyorized electrostatic paint spraying set up claimed to have saved many dollars in paint alone.

Stanley Platoz
Secretary

INDIANAPOLIS

Ruhly Talks on Stop-Offs; Holland Elected President

Forty-four members and guests attended the May 3 meeting at the Construction League. Before the meeting at 8:00 p.m., eight additional persons came. President **Les Reynolds** opened the meeting with usual introductions followed by reports from secretary and treasurer. A short report was given by **Robert Stewart,** junior member of the Tri-State, on the Cincinnati meeting, saying this meeting, the sixth one for the Tri-State, was the best one yet.

Nine new members were voted in the society by acclamation in a motion by **Quentin Shockley** and seconded by **Ed Bruck.**

The annual election of officers followed and Quentin Shockley, a board of managers member, thanked the present officers and explained how people were picked for the ticket. He said geographic conditions were considered and also those who have worked on various committees. Several nominations were made from the floor. The election was as follows: **John Holland,** president; **Steve O'Connor,** first vice president; **Mark Trook,** second vice president; Robert Stewart, librarian; **Edna Rohrabaugh,** secretary; **Paul Johnson** (1 year), treasurer; **Robert Bruck, John Hood** and Quentin Shockley, board of managers.

President Reynolds gave a farewell speech and thanked all who have so willingly cooperated the past year. He gave several good suggestions for the coming year and new officers. John Holland then took over and said the following three things: (1) that Les had established a "heck of a goal to maintain," (2) ability alone did not determine the election, and (3) if any way he can improve the Indianapolis Branch, he will do so.

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The program for the evening was given by **King Ruhly** of the Michigan Chrome and Chemical Company who talked on "Stop-Off Materials and Rack Coatings." These materials consist of lacquers, waxes, tapes, tubing, sheets, foil and hot melts. The most commonly used is lacquer and the greatest problem for the manufacture is to get a lacquer that will ahdere under all conditions, but is easy to remove. Waxes of various kinds are efficient if the parts to be stopped-off can be dipped. Wax can be applied rapidly and reused many times. Tapes are classified into pressure sensitive and not pressure sensitive. Tubing is used for ID or OD masking. Sheets and rods are available for masking. Foil is used in special cases. Molded masks are also used in special cases and rubber is the best of these. Plastisol is a new product and is finest of all rack coatings under most conditions. Mr. Ruhly was a very good speaker and told of many funny incidents and anecdotes about the stop-off materials.

Edna Rohrabaugh
Secretary

LOS ANGELES
Stoner Installs New Officers

The April 13 meeting was called to order by President **George Hetz.**

First Vice President **Frank Virgil** introduced six people who have applied for membership.

The retiring officers were applauded and then dismissed from their previous duties. The new officers were installed by **Truman Stoner.** They are: Frank Virgil, president; **Emmett Babcock,** first vice president; **Harvey Hunt,** second vice president; **Harold Wanamaker,** treasurer; **Robert Pooler,** secretary; **Don Baudrand,** educational chairman; **Norman McEwan, Clare Ver West, Norman Painter,** board of managers.

Ed Wells presented past President George Hetz with a plaque in appreciation for his service to the AES. The past president's pin also was presented to Mr. Hetz. Frank Virgil approved appointment of **Ozzie Grizat** as the Sergeant-at-Arms.

Don Baudrand, educational chairman, presented the program of the evening, consisting of films from the library of the International Nickel Company entitled "Corrosion in Action."

Robert H. Pooler
Secretary

LOS ANGELES
Gostin Presents Electroless Nickel Plating

The regular meeting on May 10 was opened by President **Frank Virgil.** Eleven guests were introduced by Sergeant-at-Arms **Oscar Grizat.** Also introduced was **Bill Griff,** a new transfer into the Los Angeles Branch. Mr. Griff was the first president of the Phoenix, Arizona Branch.

Mrs. Dolly Beckwith, chairman of the Ladies' National Convention Committee, asked support of companies in sponsoring various activities for the forthcoming convention.

First Vice President **Emmett Babcock,** read the names of three applicants for membership and then introduced six persons for acceptance.

President Virgil made the following appointments: **Bill Pardee** and **Dan H. Ross,** educational assistants to the educational chairman; **Burt Adams,** publicity chairman, responsible to the Branch secretary; **Bill G. Lidtke,** research committee chairman.

The guest speaker for the evening was **E. L. Gostin,** Metal Processing Company, Inc., Cedar Grove, New Jersey. Mr. Gostin, who was introduced by Educational Chairman **Don Baudrand,** presented a very informative paper on "Electroless Nickel Plating." Mr. Gostin illustrated his talk with slides and answered questions from the group after his presentation.

Burton G. Adams
Publicity Chairman

MEMPHIS-MIDSOUTH
New Group Hears Jumer on Electropolishing

The Memphis-Midsouth Branch (temporary charter) held a meeting April 21 at the American Legion Post No. 1, Memphis, Tennessee. **John J. Jumer** of

M1

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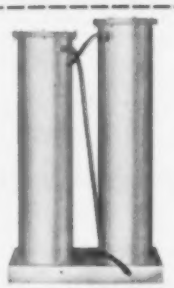

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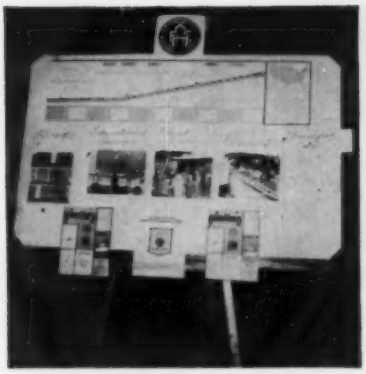

Membership display at the Empire State Regional meeting in Elmira on April 29 & 30. The display was assembled by John J. Bunsic, Southern Tier Branch, member of the AES Membership Committee.

Electro-Glo Company, Chicago, Illinois was guest speaker and spoke on Electropolishing and Chemical Polishing Steel and Aluminum. Twenty-one guests attended.

MIAMI
Gibbs Heads New Slate of Officers

Because of Good Friday, the meeting was postponed to April 22. In view of elections, **Fred Fulforth** was asked to chair the proceedings.

Elected for office were: **James N. Gibbs Jr.**, President; **Earl Kennedy**, first vice president; **M. H. "Duke" Dent**, second vice president; **Abraham Schorr**, secretary-treasurer; M. H. "Duke" Dent, librarian; **W. J. Donnelly**, M. H. "Duke" Dent, Fred Fulforth, delegates; **F. X. Marinello, Charles Posner**, J. N. Gibbs Jr., alternates; W. J. Donnelly, Charles Posner, M. H. "Duke" Dent, **Ernest Owens, Rolla Taylor**, board of managers.

It was further voted that if necessary, Southeastern Branch be designated as the proxy Branch for Miami.

Abraham Schorr
Secretary-Treasurer

MIAMI
Abrasive Belt Finishing Presented by Flanigan; Problem Clinic Started

The meeting was called to order by President **J. N. Gibbs** and was immediately turned over to **Charles Flanigan**, of the Behr Manning Co. who was the guest speaker of the evening.

He showed a newly released film "Metal Finishing with Abrasive Belts." and then proceeded to demonstrate labor saving methods with the use of abrasive belts. His program was interesting and informative.

It was voted to institute a "Problem Clinic." A portion of each meeting would be allotted to discuss problems of metal finishing. If there was no specific problem posed for immediate discussion, then someone would be designated to give a short talk on some phase of finishing, of general interest. The first designee of the continuing series is **M. H. "Duke" Dent** who will give a short talk on Plating of Jet Aircraft Parts.

The institution of the problem clinic in no way interferes with guest speaker programming.

Speedy recovery to: **Steve Putzan** from out Tampa way.

Abraham Schorr
Secretary-Treasurer

MOHAWK VALLEY
Tin and Tin Alloy Deposits Discussed by Lowenheim

The April 14 meeting at Twin Ponds Country Club, New York Mills, N. Y. was opened by President **Jack Benson** who reminded the members of the Regional Meeting at Elmira, N. Y. **Merle Ihrie**, second vice president, and Bension were named official delegates to represent our Branch. It was decided to relinquish our claim for 1961 Regional Convention in favor of Rochester Branch, it will be their 50th Year. In so doing we would expect to secure 1962 for our Branch.

Librarian **Ted Duvall** inrroduced **Dr. F. A. Lowenheim,** who spoke on "The Application of Tin and Tin Alloy Deposits."

Dr. Lowenheim stated that these deposits were not new but modern commercial baths have been developed. Tin is relatively easy to apply, but the alloys are more difficult. Research is showing some indications of very superior corrosion protection in many cases.

Soldering on this coating was cited as an outstanding advantage, also it is an advantage where dissimilar metals are used.

Some tests indicate bronze-nickel-chromium as being a superior coat. Several slides were shown and a very impressive

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case was made for the use of these baths for specific needs not now attainable in other ways.

H. J. Crouse
Secretary-Treasurer

MONTREAL
Bergin Talks on Liquid Buffing

President **R. Takeuchi** called our regular monthly meeting to order with 29 members and 3 guests present.

J. Carrique introduced **Frank Bergin** of Lea Manufacturing Co., Waterbury, Conn., speaker for the evening. He gave a very interesting and enlightening talk and showed some excellent slides on liquid buffing, after which he answered many questions from the floor. He was thanked on behalf of the Montreal Branch by **B. Millward.**

After a short business session, nominations were closed and the Branch held its annual elections. Our new executive will be installed in office at our next meeting.

R. W. Niggemann
Secretary

MONTREAL
Dicaire Presents Paper; New Officers Installed

Our regular monthly meeting was called to order by our President **R. Takeuchi** with 22 members and 3 guests present. He called upon **H. Baka** to introduce **Louis Dicaire** of Armalite Co. Ltd., Montreal, P.Q. our speaker for the evening. His topic was Dupont Leveled Copper. He gave a very interesting and enlightening talk and showed some excellent slides, after which he answered questions from the floor. Louis was thanked on behalf of the Branch by **Harold Wilson.**

After a very short business session our newly elected executive was installed in office by our senior member, **J. T. Reisenburg.** Mr. Reisenburg was thanked by our new president, **John Rennie,** who said he and his executive would do their utmost during the forthcoming year for the continued success of the Montreal Branch.

R. W. Niggemann
Secretary

Diplomas were presented to the graduates of the Newark Branch 1960 Electroplating Class at the May Branch meeting. Shown above are the graduates and their instructors.

NEWARK
Ward and MacNeil, Speakers; Plating Class Graduates

The May meeting of the Newark Branch was held on the 19th with 90 members and guests in attendance.

Three applications were accepted, and a former member of the Branch transferred back to the fold.

It was reported that **Tom Haddow** was ill, and the secretary asked his friends and acquaintances to visit him at Orange Memorial Hospital.

Librarian **Cy LaManna** announced the tentative program for the second Metropolitan Regional Meeting to be held in Newark in September and urged us to set

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aside the date. Following this Messrs. LaManna, Foulke and Banta presented certificates and congratulated the 36 members who successfully completed the Electroplating Course sponsored by the Branch.

Cy LaManna presented **Dean Ward** whose timely topic was Electropolishing. He explained electropolishing in general, and indicated its usefulness as a tool for deburring, polishing and as a pretreatment for plating. In order not to mislead anyone, he stated that the problems were many and that numerous alloys and pretreatments are not conducive to good electropolishing. The subject was well covered for the short time allocated to it.

Charles MacNeil then spoke on Metal Finishing and Missile Applications. He started by showing a very interesting film on the Bull Pup Missile made by the Martin Co. He proceeded to explain how the engineering staff research the present art of metal finishing for use in missile applications for both government and civilian customers.

At present they are aiming for a minimum of five years of storage life. This is being obtained by using 14 types of plated coatings and 16 types of organic formulations for the various parts.

New areas which they are investigating are room temperature phosphating, chromating of magnesium, plating of plastics to reduce weight and metal costs, flame spray coatings and gas plating.

Gustav Bittrich
Assistant Secretary

PHILADELPHIA
Swalheim Discusses Cyanide Copper Plating

The final meeting of the 1959/60 season was held on May 23 at the Engineers' Club with more than 50 attending. Following introduction of guests by Second Vice President **Hauseman,** Librarian **Berenato** introduced the speaker, **Dr. D. A. Swalheim,** du Pont Co., whose subject was "Cyanide Copper Plating."

Dr. Swalheim's talk was an exposition of a newly developed, high speed, bright cyanide copper plating bath being marketed by his company. With the aid of slides, he described physical properties of the deposit, solution composition and operating conditions and purification treatments. A method developed by du Pont to evaluate deposit leveling was described; this should be published as a separate paper.

Librarian Berenato, as his final words as Branch librarian, urged all platers to seek this office because of the valuable information obtained from speakers during the informal contacts before the speakers give their talks.

The secretary read the minutes, Treasurer **Mentzer** gave the financial report and three active members were admitted. Branch President **Cogan** announced that March 4, 1961 had been tentatively reserved at the Benjamin Franklin Hotel for the next annual educational session and banquet, due to no February dates being available. A motion was passed that a date for the annual affair in the latter part of January be secured if available, otherwise the March 4 date should be accepted.

The following were elected to serve for the 1960/61 term of office: President—James E. Cogan Jr.; first vice president—Irvin K. Hauseman; second vice president—Joseph W. Berenato Jr.; secretary—**I. Wm. Marcovitch;** treasurer—**John R. Ross;** librarian—**Donald H. Marsh;** board of managers (three year term)—**George B. Valentine Jr.;** delegates: James E. Cogan Jr., I. Wm. Marcovitch, **Dr. Samuel Heiman;** alternate delegates: **Paul Mentzer Sr.,** Irvin K. Hauseman; **Robert L. Farren.** The newly elected officers were inducted by Branch Past President **Trusdell,** the new term to start July 1.

I. Wm. Marcovitch
Secretary

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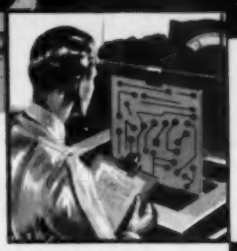

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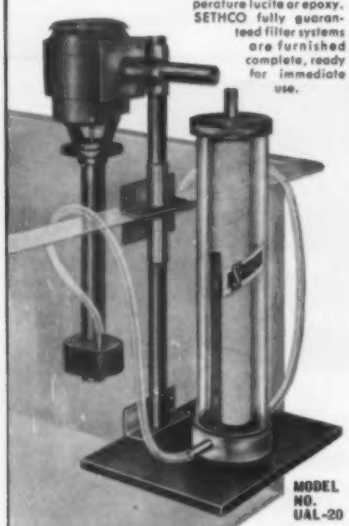

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ST. LOUIS

Diebold Discusses Transparent Coatings

The regular monthly dinner meeting was held at the York Hotel, Wednesday night, May 11 with 25 present for dinner. The business meeting was called to order by our President **William Piel** with 38 members and guests present. The large attendance was due to the members of the plating school being present to obtain their certificates.

There was a short business session which consisted of **Lou Berra** reporting on the success of the spring banquet and **Andy Julius** reporting on his trip to the Mid-west Regional meeting. Andy suggested that we should combine an educational session with our annual spring banquet.

Ward Kelly was called on to present the certificates to the graduates of the plating school. The following were present to receive their certificates: **Sanford E. Akins,** Louis J. Berra, **Elgert Crocker, Kermit H. Diebold, John W. Eggeman Jr., George Forir, Stephan Kirchner,** William H. Piel, **Charles Sweeney, Mahesh Pratap Singh, Samuel F. Taylor, Louis Voelker, Robert Wann, William Wann, Richard Wade,** not present but completing the course was **Vincent Toth.**

Andy Julius installed the new officers for the coming year. **George Koderhandt** was installed as president, **Homer Thomen** as first vice president and **Pete Young** second vice president. Louis Berra and Ward Kelly retained their positions of treasurer and secretary respectively.

William Piel presented **William George,** president 1958–1959, with a past president pin and his gavel. George Koderhandt took over the meeting and presented William Piel his gavel and past president pin. George Koderhandt was given his gavel to conduct the business meetings for the coming year.

Librarian **Richard Gotsch** introduced Kermit Diebold, chief engineer of Peerless Lacquer and Chemical Co., St. Louis. Mr. Diebold talked on "Transparent Coatings for Metals." He had many samples to show the different coatings. He pointed out that the epoxys appear to have more strength and cure at room temperature. Lacquers, however, have to be compounded to meet certain requirements. Some may have to be ductile, others have to have superior adhesion. There are very few standard formulae.

Ward Kelly
Secretary

SAN FRANCISCO

Election of Officers; MacDonald Speaks on Additives

After brushing off the stragglers from the Giants baseball game, the monthly meeting of the San Francisco Branch was finally brought to order by President **Trevor Harry** at 9:15 p.m. We had 30 members present.

Librarian **Murray Hart** introduced our guest speaker **C. R. MacDonald** of the C & M Plating Co. Mr. MacDonald presented a very interesting talk on "Suggestions on the Use of Common Purification Aids and Additives to Electroplating Processes." After the speech there were many questions and experiences offered as aids to proper control and handling of the solutions and chemicals used in the plating industry.

Our entire meeting was presented with the aid of a Portapodium public address system graciously loaned through the Holly-General Co., Division of the Siegler Corp., to show the value of such compact systems for technical presentations.

A large part of the business meeting was engaged in the election of our 1960–61 officers. The following were elected: **F. M. Condrott,** president: **Stanley Bammann,** first vice president; **Elston A. Flores,** second vice president; **Calvin E. Snelgrove,** secretary-treasurer; **Richard L. Mitchem,** librarian; **Murray Hart, Duane J. Heinlen, Julius Carl Tervay,** sergeant-at-Arms; **J. R. Pattenger, Harold Smallman, Dominick Maviglia, Fred Huntington,** Trevor G. Harry, board of managers.

Due to the delay caused by a deluge of baseball fans swamping the restaurant facilities, the meeting ran late. A motion to adjourn was eagerly seconded and the meeting closed at 10:30 p.m.

C. E. Snelgrove
Secretary-Treasurer

SAN FRANCISCO

Nichols Installs Officers and Is Guest Speaker

The May meeting of the San Francisco Branch was called to order Friday, May 6, by President **Trevor Harry.** Introduction of guests was performed by second Vice President **Stan Bammann.** Two guests were present.

Mr. Harry introduced our guest speaker, **John P. Nichols,** AES National Executive Secretary. Mr. Nichols officiated during the installation of the 1960–61 San Francisco officers. Pictures of the inauguration were taken by **Julio Battaion.**

Mr. Nichols presented the engraved gavel to our new president, **F. M. Condrott,** who took over the meeting from outgoing President Trevor Harry. A vote of confidence for our past president and all of last year's officers was given.

Mr. Nichols, during his address, discussed our growing western Branches. He pointed out that "AES is education—technical knowledge for self improvement." Mr. Nichols announced the Memphis Midsouth Branch as having been temporarily chartered as AES's 59th Branch.

(LEFT) AES National Executive Secretary John P. Nichols addressing the San Francisco Branch on May 6, during his West Coast trip. Branch President F. M. Condrott seated at the right. (CENTER) The 1960-61 officers of San Francisco Branch, l to r, F. M. Condrott, president; Julius Carl Tervay, sergeant-at-arms; Stanley Bammann, first vice president; Calvin E. Snelgrove, secretary-treasurer; Duane J. Heinlen, sergeant-at-arms; Elston A. Flores, second vice president; Richard L. Mitchem, librarian. (RIGHT) The 1960-61 officers were installed by National Executive Secretary Nichols, left, presenting engraved gavel to Branch President Condrott. First Vice President Bammann at extreme right.

A discussion of the possibility of forming a West Coast regional group was placed before the San Francisco membership by Mr. Nichols. It was agreed to place this suggestion under consideration.

Mr. Condrott thanked our guest speaker and invited questions from the floor.

Our business meeting was opened and the following brought before the membership: 1) Discussion of picnic plans. Stanley Bammann will investigate facilities at Laurel Park. 2) It was decided to discuss the educational session at the June meeting. 3) A motion was made to procure a hospitality room at the Statler for the Annual Convention in July. The following committee was selected for this detail: **Harold Smallman, C. E. Snelgrove.**

C. E. Snelgrove
Secretary-Treasurer

SAN FRANCISCO Plans Developed at Officers Meeting

The May 24 officers meeting was held at the International Inn. The following are some of the points brought before the officers:

1. A suggestion to have available for all San Francisco members present at the Los Angeles convention a lapel button with an appropriate cable car design. **Dick Mitchum** was assigned to detail this project.

2. Librarian Mitchum made report on status of the speakers list. The following points were detailed:

(a) Organize panel board discussions at monthly meeting.

(b) Develop some plant visitation.

(c) Organize San Francisco speakers list for entire year.

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1—**H-VW-M** Selenium 5000 Amp., 6 V. S.C.F.C. 440/3/60.

3—**H-VW-M** Selenium 3000 Amp., 6 V. S.C.F.C. 440/3/60.

1—**THER** 1500 Amp., 6 VOLT DC for 220/3/60 AC remote control.

1—**NEW G. E.** 2000/1000 AMPS., 6/12 V. Remote Control 440/3/60 AC.

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2—**CROWN** Centrifugal Driers No. 1 with Heat.

1—R100 **RONCI** Enameler.

3—**LASALCO** Bell Burnishers, No. 1, 2 & 4, Lined or Unlined.

10—Buffing Lathes—**HAMMOND, DIVINE, U. S.,** etc., from 3 H.P. to 20 H.P.

3—**INDUSTRIAL** RDR-1 & 2 Rubber Lined Filters, Sizes 10x28, 14x36.

2—**INDUSTRIAL** Type SC Filters for Cyanide. 18x48 and 18x36.

1—**HAMMOND** 7½ H.P. Variable Speed Buffer.

1—**L'HOMMEDIEU** 5 H.P. Variable Speed Buffer, Model 18 and **DIVINE** 5 H.P. Variable Speed Buffers.

4—**STEVEN BADER** Abrasive Belt Polishers

3—**AMERICAN** Blower type HS fans. Size 330-10.

10—**DUSKOP** Dust Collector Cabinets. Sizes No. 550, No. 850, No. 1100.

1—NEW Model B **NIEHAUS** S. S. fume separator.

1—**H-VW-M Munning-** Type (Mechanical lift), Full Automatic, Plating Machine 70' long x 4' wide x 36" deep x 10½' overall height.

2—**CROWN** 48 x 36, 2 compartment horizontal tumbling barrel lined or unlined.

7—**MERCIL** Nickel plating barrels 12" x 36" with R. L. tanks.

1—**ACME** L8L Semi-Automatic buffing machine. 8 spindles with 2 7½ HP heads.

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(d) Suggestion to send complete San Francisco membership roster with invitation to the speaker so that he may know the members and the firms that will be represented at his speech.

3. Interest for San Francisco's first annual educational session is growing. A motion in favor of this plan was made and recorded.

The following details were discussed:

(a) The educational session and dinner dance would be organized as a one-day affair.

(b) Saturday, February 14, 1961 was selected as the date.

(c) Three technical papers will be presented in the morning and three in the afternoon.

(d) Following the technical session will be a dinner dance appropriate for Valentine s Day celebrations.

(e) A discussion was raised regarding possible support for the North-West Branches.

A motion was made and seconded regarding the February 14, 1961 date.

4. Membership Drive—It was discussed and a motion made and seconded to develop an incentive plan for the membership drive. On February 14, 1961 the presentation of a transistor radio will be given to the member bringing in the most new members between now and next February 14.

5. Picnic Plans—**Stan Bamman** presented information on picnic locations. The picnic date was tentatively set for second or third Sunday in September. Suggested attaching rider on next meeting notice regarding picnic. A motion was carried to further discuss and decide at the June membership meeting.

6. Formation of Committees:

(a) First Vice President Stan Bamman, chairman of Membership and Reception Committee.

(b) Second Vice President **Elston Flores,** chairman of Attendance and Entertainment Committee, organize telephone calls from each area.

(c) Secretary **C. E. Snelgrove,** chairman of Publicity Committee, contact local papers, send articles to speaker.

(d) Librarian Dick Mitchum, chairman of Educational Committee.

(e) Board of Managers: **Trevor Harry, Harold Smallman, J. R. Pattenger, Fred Huntington, Dominick Maviglia,** head of Finance and Budget Committee.

7. Board President **Guy Condrott** stressed importance of each chairman to organize committeemen for the formation and execution of the functions of each committee.

C. E. Snelgrove
Secretary-Treasurer

SEATTLE-PUGET SOUND
Nichols Speaker During West Coast Trip

The May meeting of the Branch was held on May 4, 1960 at Andy's Diner. Dinner preceded the election of officers, and after a very short meeting, **John P. Nichols,** National Executive Secretary, was introduced.

Mr. Nichols gave a very interesting discussion on the value of the Branch and Supreme Society to the individual members, and the duties and privileges of the Branch to the National Society.

Mr. Nichols' talk was very informative to the new officers.

The meeting was turned over to the new Branch President who again thanked the speaker, Mr. Nichols.

SOUTHEASTERN
Record Meeting; D & L Plating Open House

The largest attendance and most enthusiastic regular monthly meeting in the history of the Branch was held on March 18

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in Carrollton, Georgia. The sponsor was **Pat Milikin,** the plant manager of D & L Plating Corp. **Vince Cashen,** plant manager of Douglas and Lomason Company, and vice president of the Branch, also assisted in the arrangements.

D & L Plating was open for visitors all day. Sixty-seven members and guest toured through the modern plating plant during the day. Polishing, plating and anodizing operations on production scale were in full exhibit for the guests.

In the late afternoon there was a gala cocktail party at the local Dixie Motel. It is reported that straws were used as there was no room to bend elbows. After such an interesting plant tour, the colorful cocktail party and the usual chatter of Southeastern platers talking shop, the 67 hungry people went to the local country club for a delicious steak dinner.

A short business session featured a report on the Philadelphia Interim meeting by **George Taylor.** George also suggested that more of the same type of monthly meeting be considered and this suggestion was still on the floor when **Robert B. Taylor** of General Time in Athens invited the Branch to meet at their plant on April 22. The invitation was quickly acted upon and accepted. So we will have another plant tour type meeting in April, this time Robert B. Taylor will be host.

George Taylor introduced the speakers for the evening. All of the speakers were local talent drawn from either Production Plating in Adel, Georgia or D & L Plating in Carrollton, Georgia; 1) **Jack Brunson,** Production Plating Co., on "Microscopic Examination." 2) **Dick Crawley,** Production Plating, on "Bright Dipping Aluminum Automotive Trim." 3) **David Barlet,** D & L Plating on, "Laboratory Control for Plating and Anodizing Quality."

Mr. Bartlet's talk was illustrated by a demonstration by **Tom Rooks** of D & L Dick Crawley illustrated with laboratory samples. Bob M. Taylor of Production Plating conducted the traditional question-and-answer session as questions from a full day's activities were voiced.

The largest meeting the Branch has ever recorded was closed by a loud clatter of applause in recognition and appreciation of the all day hospitality so generously prepared by Pat Milikin and Vince Cashen.

H. R. Stogner Sr.
Secretary

SOUTHEASTERN
Sherry on Crystallography; New Officers Installed

Thirty-two people, including three ladies, from Greater Atlanta, Adel, and Rome, Georgia; Anniston and Birmingham, Alabama; Conover, North Carolina; and Detroit, Michigan; met at the Architects and Engineers Institute in Atlanta on Friday, May 13.

After a buffet style dinner with fish and chicken, President **Bob M. Taylor** opened the meeting by reporting on the success of a previous meeting at General Time in Athens, Georgia. Bob Taylor went on to announce that normally there is no meeting in June, but it was then decided to meet in June.

For the August ladies night, **Clem Hohner** was named chairman, to be assisted by **Jerry LaChappell** and **Harry Pink.**

The librarian-elect, **George W. Taylor,** cited the success of the company sponsored meetings in Carrollton and Athens and announced that his new program as librarian will lean towards more such company sponsored meetings; half in and half out of Atlanta. George Taylor asked for further suggestions. He stated that he already has several volunteers and expects a lively, enthusiastic coming year.

Bob Taylor recognized that **Dave J. Griffin** was one of the members with the longest service present and called upon him to install the new officers. Dave was his usual outstanding, oratorical self as he very ceremoniously converted electees into officers. Bob Taylor handed his gavel to **Myron M. Randman** who became the new Branch president, **Vince Cashen** was installed as first vice president and membership chairman, **R. Bruce Taylor** became second vice president, **H. R. Stogner Sr.** was reinstalled as secretary and treasurer, George W. Taylor became the librarian, **Robert H. Probert,** recently transferred back into Southeastern, was appointed assistant secretary, a newly created informal office.

The librarian, **Harold Willingham,** introduced the speaker for the evening. **Dr. Peter B. Sherry,** assistant professor of chemistry, Georgia Institute of Technology, who delivered the final of a series of two talks on "Crystallography or Recent Developments in the Nature of Metal Surfaces." Dr. Sherry went into the latest practical and theoretical findings in the nature of growth in crystals along flat, indented and other types of metal surfaces; illustrating clearly on a large blackboard and with actual models of crystal lattice structures. A more attentive and interested local meeting has never been witnessed. Dr. Sherry's subject matter and presentation was interesting to everyone.

Robert H. Probert
Assistant Secretary

SPRINGFIELD
Milne Talks on Plastics

The Springfield Branch met at Blake's Restaurant, on Monday evening, April 25, for the regular monthly meeting. As soon as dinner was over, incoming President **Alexander Salmond** opened the business meeting.

The Branch secretary announced there were several programs available from the previous Saturday's Regional Meeting, which was such a huge success. Also made available, were copies of the brochures for the Providence-Attleboro Conference on Industrial Electroplating and Metal Finishing, Saturday, May 21 at the University of Rhode Island.

Charles F. Griffin Jr. made a motion to organize a committee and appropriate funds in support of the candidacy of **Robert J. Girard** in his campaign for the national office of third vice president. This met with enthusiastic and noisy approval. The following were appointed to help Bob: **Wayne B. Sanders,** Charles F. Griffin Jr., Alexander R. Salmond, **John E. Costigan, Elery C. Gibson** and **Harold Mitchell.** Of course, **Arthur Logozzo** of Hartford is coordinator. Charles Griffin explained that due to Bob's integrity and service on national and regional and local levels, complete endorsement and

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recognition is called for, and asked for a vote of confidence. This was immediately seconded and unanimously voted for by the attending members.

The Activities Committee gave a brief report on the coming annual golf outing, installation of officers and banquet. The affair is to be held at the Whippernon Club, in Russell, Saturday, June 11.

Bob Girard introduced **Chet Klimek,** formerly a Springfield Branch President, and now a member of the Capitol District Branch and one of the organizers of the Branch.

President of the Hartford Branch, **Walter J. Dyber,** extended an invitation to attend the May 16 meeting of the Hartford Branch which will include a tour of the Royal-McBee plant and dinner.

Paul Lane, technical chairman, introduced **William N. Milne,** vice president of engineering at the Carl W. Beetle Plastics Corp., Fall River, Mass. Mr. Milne spoke on Reinforced Plastics and Laminates. Mr. Milne accompanied his talk with a number of explanatory slides, in color.

Although there was a fair sized group present, room could have been made for more.

Henry L. Heissfeld
Secretary

WATERBURY
Beckwith Presents Paper on Duplex Nickel

The Waterbury Branch of the American Electroplaters Society held its April meeting at the Roger Smith Hotel on April 14. Final arrangements were made for those who planned to attend the 21st Annual New England Regional Meeting. Approximately 150 people are planning to attend from Waterbury.

One new certificate of membership was awarded.

Technical Chairman **Lewis Doughty** introduced the speaker for the evening. He was **Dr. M. M. Beckwith** of The Harshaw Chemical Co., who spoke on Duplex Nickel Plating. Dr. Beckwith presented an excellent paper supported with numerous slides showing results of accelerated and exposure tests which demonstrated the effectiveness of duplex nickel plating in inhibiting corrosion failure of nickel-chromium plating.

Francis A. Schneiders
Publicity

WATERBURY
Cassell Speaker on Old Timers Night

The Waterbury Branch held its annual "Old Timers Night" on Thursday, May 12, at the Roger Smith Hotel. Among the festivities was the installation of the officers for the coming year conducted by **Henry Strow.** The new officers are: President, **William Giesker;** first vice president, **Louis Porretti;** second vice president, **Albert Griffith;** librarian, **Patrick Mazzamaro;** and secretary-treasurer, **James Kennedy.**

Secretary Jim Kennedy announced that the 21st New England Regional Meeting had been a complete sell out.

Earl Couch introduced the guest speaker, **Wes Cassell** of the Lea Manufacturing Co. who spoke on the "Historical Development of the Chromium and Cadmium Plating Processes." Mr. Cassell started in the plating business working for the pioneers of the two processes and had many stories and facts about the early development and marketing of these processes. The talk was well received by the many members and "Old Timers" present. After the meeting refreshments were served. This was the last regular meeting of the season.

F. A. Schneiders
Publicity

WESTERN ONTARIO
Tour Dow Plant; Officers Installed

The Western Ontario Branch held its May meeting with a plant tour of Dow Chemical Co. of Canada, Sarnia, Ontario. **Norm Bremner** and **Ray Alcock** along with the other plant personnel guided 35 members and guests through Dow's laboratories, glycol, styrene and caustic departments and many other areas of their plant, explaining the different phases of each. This proved very interesting to everyone. After the tour the Branch was taken to Dow's Staff House where they were royally treated to a buffet dinner. After dinner, President **Leo Horodyski** called a short business meeting and installed the following officers for the coming year. **Jim Kelly,** president; **Bob Dobson,** vice president; **Jim Marshall** secretary-treasurer; **Don Berry,** librarian.

After the meeting a social hour was enjoyed.

Bob Dobson

AES MEMBERSHIP REPORT

ELECTIONS

British Columbia: H. Georgelin

Cincinnati: J. E. Stary, C. C. Seymour, F. Knight, J. R. Schlotterbeck Sr.

Cleveland: F. J. Fidel

Columbus: K. J. Cave

Dayton: K. E. Wray, M. W. Baker

Denver: A. B. Staley, M. Korte, R. J. Ming, T. C. Sevier, B. Gagnon

Detroit: W. T. Chisholm, W. H. Vedder, R. J. Puskas, Mrs. I. S. Stark

Grand Rapids: C. A. Lachstadter, J. R. Duchene, E. C. Verity

Indianapolis: C. H. Reynolds, R. L. Bowers, G. Reagan, R. E. Thomas, K. L. Turpin, D. E. Kincaid, M. Plummer, T. D. Hathaway, J. A. Anoskey

Kansas: W. R. Gage Jr.

Lancaster: J. J. Moscony, J. E. Lafferty

Memphis Mid-South: C. R. Veach

Newark: M. R. Vretenar

New York: M. T. Allena, V. C. Harrigan, H. Rothman, T. A. Downey

Philadelphia: F. H. Kletka, F. L. Hencke, H. K. Chase, F. C. Hayward, J. T. Hogan, W. R. Hamilton, Miss M. R. Eakin, C. DeLuca, J. H. Bell, C. Hobbs, W. J. Johnson, W. Kamarek, J. J. LaRuffa, D. C. Notarfrancesco

Seattle-Puget: A. M. Mosher

Southeastern: D. M. Avera

Southern Tier: D. Kattell, R. Clifford, H. Connor, F. R. Gibbs, E. A. Bucher

Syracuse: T. E. Nugent, M. Moore

Toronto: J. O'Connor, T. H. Bennett, W. Graham

Member-at-Large: W. J. Fredrick, I. J. Grestale

REINSTATEMENTS

Central Michigan: B. N. Sisco, H. E. Kratzer

Columbus: G. Osterfeld

Dayton: M. Kiminas

Louisville: R. Groom

Newark: A. H. Lott, R. Corsini

Syracuse: J. Johnson

Member-at-Large: R. Teichmann

TRANSFERS

Blue Ridge: R. Probert to Southeastern

Buffalo: Mrs. J. Wiarda from Chicago

Indianapolis: Dr. B. Agruss from New York

Louisville: R. Groom to Newark

Philadelphia: D. H Ross from Chicago, J. Manzella from Saginaw Valley, A. G. Cafferty from Chicago, M. A. Manning Jr.

Southeastern: R. L. Griffin Jr. from Member-at-Large, W. H. Head Jr. from Blue Ridge

RESIGNATIONS

Boston: L. C. Berman

Cincinnati: J. J. Visse

Indianapolis: W. G. Niehaus

Syracuse: F. F. Kennedy

Toronto: D. Lawson

Western Ontario: A. W. Johnson

SUSPENSIONS

Boston: R. T. Marshall, R. Marshall, E. D. Carr

Lancaster: H. Stoll, R. P. Baker, G. Cockley, S. R. Keator, J. C. Mecham, H. Saylor, H. J. Schnieder

Montreal: C. Butterman, R. Guertin

Syracuse: A. Saitz, A. Cahill

DEATHS

Philadelphia: H. E. Maack

CLASSIFIED ADVERTISEMENTS

Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.30 per word, minimum $5.00. AES Branch Members and Members-at-Large only, in good standing, are entitled (for personal use only) to a total of three free advertisements in any twelve-month period as of first insertion. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J.

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HEAVILY EXPERIENCED PLATING SPECIALIST—27 years in every phase of the industry from tank man to shop owner. Qualified in production engineering, estimating, laboratory, management—small shop to the largest. Available in September. Interested in technical sales or top management. Reply Box Jy 3, PLATING, 445 Broad St., Newark 2, N. J.

SALESMAN—METAL FINISHING—Experienced—Midwest territory. Have College degree and practical knowledge of plating, painting, finishing, etc., in metal finishing. Would like guarantee while building up sales to commission standing also contract for first year. Would consider being a manufacturer's representative. Reply Box Jy 4, PLATING, 445 Broad St., Newark 2, N. J.

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CHEMICAL ENGINEER—Chemical Engineer or B.S. in Chemistry required. Must have extensive experience in electroplating copper, tin-lead and gold. Also requires some experience in electroless deposition of copper film on non-conductive surfaces. Requires experience in the close control and applications of solutions to produce the above plated materials in the manufacture of plated-through-hole printed circuitry. Experience coordinating machining and printed circuit electroplating desirable. This engineer will aid a current transition from pilot plant to full-scale production and will be expected to trouble shoot potential production problems. Reply Box Jy 5, PLATING, 445 Broad St., Newark 2, N. J.

METAL FINISHING CHEMIST—Chemical Investigator required for independent research projects concerned with metal finishing. Position requires a sound background in organic chemistry and working knowledge of metal coatings techniques and evaluation tests. Applicant must have a knowledge of industrial practices and requirements for protective coatings for metals acquired through several years' of experience with metal paints or conversion coatings.

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Golf spectators at the 1959 Stag Day of Detroit Branch, AES.

NEW ATTRACTIONS PLANNED FOR DETROIT BRANCH STAG DAY

Advance word from the Detroit Branch of the American Electroplaters' Society foretells a Stag Day that should even outshine those enjoyable Stag Days of past years. It will be held this year on Saturday, August 6, at the Glen Oaks Country Club, 13 Mile Road in Farmington, a suburb of Detroit.

Golf will be in order all day, starting early in the morning. Free beer and soft drinks will be served at two bars. The ever-popular egg throwing contest is scheduled for 3:00 p.m.—prizes, of course.

A broiled sirloin steak dinner will be held at 12:30 in the main dining room and at 2:00 p.m. in the grill—an innovation this year. New also will be a floor show in the main dining room at 4 o'clock in the afternoon. Valuable door prizes will be distributed right after the floor show.

Detroit Branch is planning to play host to about 800 AESers and guests. Tickets for the Stag Day are $9.00 each and can be obtained from Louis J. Camill, Allied Research Products, Inc., 400 Midland Avenue, Detroit 3, Michigan. It is requested that checks be made payable to AES Detroit Branch Stag Day.

◆

INDEX EXTENDS COVERAGE OF CHEMICAL PATENTS

More than 63,000 chemical patents issued by the U. S. Patent Office from 1953 through March 1, 1960 are now covered by Uniterm Indexes published by Information for Industry, Inc., 1000 Connecticut Ave., N. W., Washington, D. C.

A new Uniterm Index just printed of chemical patents issued in 1953, when added to the IFI indexes published from 1954 through the first two months of 1960, gives finger-tip access to more than 2,500,000 technical references to material contained in the 63,000 U. S. chemical patents covered.

The fields covered by the indexes include, among others, detergents, metallurgy, electrochemistry, silicones, coatings, paints, varnishes and lacquers.

◆

DYNA-EMPIRE APPOINTS EXPORT SALES REPRESENTATIVE

Dyna-Empire, Inc., Garden City, New York, announces the appointment of Electronic Manufacturers' Export Company (EMEC), 127 Grace Street, Plainview, New York as export sales representative of their entire commercial and industrial product lines.

The industrial product line includes gaussmeters, plating thickness measuring devices, underwater hydrophones, sonar transducers, industrial demagnetizers, and other magnetic instruments.

FUTURE MEETINGS

AMERICAN ELECTROPLATERS' SOCIETY

July 24-28, 1960—47th AES Annual Convention, Hotel Statler, Los Angeles, Calif.

July 24, 1960—Executive Board Meeting, Statler Hotel, Los Angeles, California.

August 6, 1960—Detroit Branch Stag Day, Glen Oaks Country Club, Farmington, Michigan.

September 16, 1960—Second Metropolitan Regional Technical Session, Newark Host Branch, Robert Treat Hotel, Newark, N. J.

September 17, 1960—Boston Branch 24th Annual Educational Meeting and Banquet, Hotel Statler, Boston, Mass.

September 24, 1960—Montreal Branch Annual Banquet, Queen's Hotel, Montreal, P. Q., Canada.

October 29, 1960—Second Annual Midwest Regional Conference, University of Notre Dame, South Bend, Indiana. St. Joseph Valley Host Branch.

December 2-3, 1960—Detroit Branch Annual Educational Meeting and Banquet, Statler-Hilton Hotel, Detroit, Mich.

December 16-17, 1960—Newark Branch Annual Educational Session and Christmas Banquet, Robert Treat Hotel, Newark, N. J.

January 28, 1961—Chicago Branch Annual Meeting and Banquet, Conrad Hilton Hotel, Chicago, Ill.

February 3-4, 1961—Third Annual Dixie Regional Technical Session, Hotel Roanoke, Roanoke, Virginia. Blue Ridge Host Branch.

February 4, 1961—New York Branch Annual Educational Session and Banquet, Hotel Statler-Hilton, New York, N. Y.

February 4, 1961—Saginaw Valley Branch Annual Educational Session and Banquet, Frankenmuth, Michigan.

February 4, 1961—Seventh Annual Tri-State Regional Meeting, Deshler-Hilton Hotel, Columbus, Ohio.

February 11, 1961—Eighth Interim Meeting, Supreme Society, Statler Hotel, Hartford, Connecticut. New England Regional Council, Host.

February 14, 1961—San Francisco Educational Sessions and Dinner-Dance, San Francisco, Calif.

March 4, 1961—Philadelphia Branch Annual Technical Session and Banquet, (Tentative Date) Benjamin Franklin Hotel, Philadelphia, Pa.

March 4, 1961—Dayton Branch 15th Annual Educational Session and Dinner Dance, Biltmore Hotel, Dayton, Ohio.

April 29, 1961—**Milwaukee Branch Annual Educational Session and Banquet,** Schroeder Hotel, Milwaukee, Wis.

May 2, 1961—**Central Michigan Branch Annual Educational Session and Banquet,** Hotel Hayes, Jackson, Michigan.

June 18-23, 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass.

June 25-28, 1962—**49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24-27, 1963—**50th AES Annual Convention,** Ambassador Hotel, Atlantic City. N. J. Sponsorship Newark Branch.

June 15-18, 1964—**51st AES Annual Convention,** St. Louis, Missouri.

June 28-July 1, 1965—**52nd AES Annual Convention,** Statler Hotel, New York, N. Y.

INTERSOCIETY

July 22-24, 1960—**National Association of Metal Finishers,** 5th Annual Convention, Hotel Statler, Los Angeles, Calif.

July 24, 1960—**Metal Finishing Suppliers' Association,** Board of Trustees Meeting, Hotel Statler, Los Angeles, Calif.

July 25, 1960—**Metal Finishing Suppliers' Association,** Annual Luncheon and Meeting, Hotel Statler, Los Angeles, Calif.

September 7-15, 1960—**2nd Coliseum Machinery Show,** Chicago Coliseum, Chicago, Ill.

September 26-30, 1960—**Instrument Society of America,** 15th Annual Meeting; Instrument-Automation Conference and Exhibit, Coliseum, New York, N. Y.

October 9-13, 1960—**The Electrochemical Society,** Fall Meeting, Shamrock Hotel, Houston, Texas.

October 12-14, 1960—**American Vacuum Society,** 7th National Symposium, Cleveland-Sheraton Hotel, Cleveland, Ohio.

October 17-21, 1960—**American Society for Metals,** 42nd National Metal Exposition and Congress, Trade and Convention Center, Philadelphia, Pa.

October 25-27, 1960—**National Association of Corrosion Engineers,** South Central Region Conference, Mayo Hotel, Tulsa, Okla.

November 8-11, 1960—**Society of Die Casting Engineers,** First National Die Casting Exposition and Congress, Detroit Artillery Armory, Detroit, Mich.

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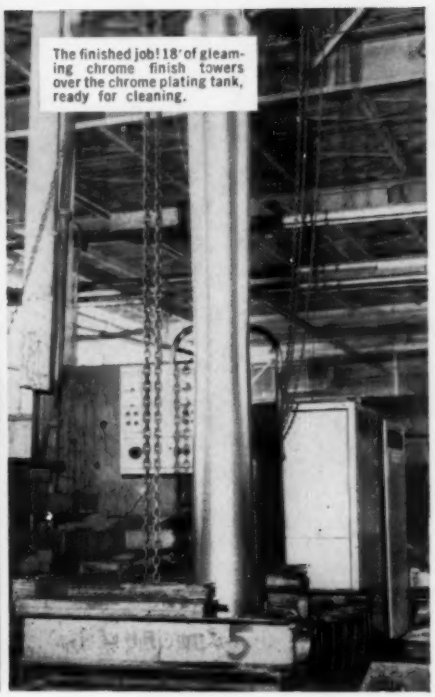

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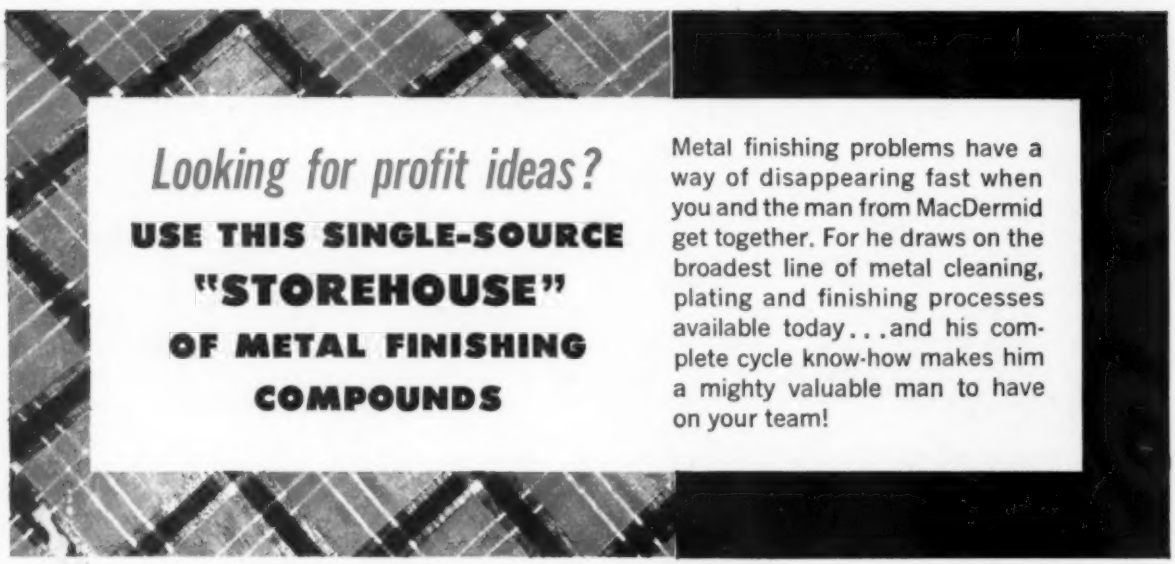

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